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The
Geographical Journal.

No. 5. NOVEMBER, 1905. Vol. XXVI.

SURVEYS AND STUDIES IN UGANDA.*

By Lieut.-Colonel C. DELMÉ-RADCLIFFE, M.V.O.

I. The Nile Province.

In June, 1899, when at Mumias, in Kavirondo, I received orders to proceed to the Nile Province or Nile Military District, as it was then called, to take over the civil and military charge from Colonel Martyr, who had returned after having established stations at Wadelei, Lamogi, Affuddu, and Fort Berkeley. Since Emin Pasha's day, and until Colonel Martyr's expedition, the only white men to approach this part of the world had been Owen, Thruston, and Vandeleur, who pushed down the Nile in the old steel boat as far as Wadelai.

Of the stations first occupied by us, Lamogi was abandoned, Affuddu was shifted to Nimule (a better site), and Fort Berkeley was shifted to Gondokoro, as the steamers could not get higher than that point up the river at low water.

When I passed through Kampalla on my way to the Nile, Colonel Ternan, then acting Commissioner in Uganda, requested me to survey as much as possible, and lent me a very good plane-table with a telescope alidade. Besides this, I had a 3-inch mountain theodolite, a pocket sextant, and a few sketching instruments. Unfortunately, the pressure of administrative and other duties made it impossible to devote much time to survey. I measured with a steel tape a base near Affuddu, and another near Wadelai. From both of these a triangulation was extended with the small theodolite, and carried on with the plane-table. The mapping was done on a scale of 2 miles to the inch, with contours at

* Read at the Royal Geographical Society, May 8, 1905. Map, p. 592. For Map of the Nile Province, see *Geographical Journal*, vol. 21, p. 220.

100-feet vertical intervals. In the Lango country even this amount of work could not be done, and the map of this part, being based on very inadequate material, must be extremely incorrect.

Of the old station of Wadelai, on the left bank, the parapets and ditches are still in a fair state of preservation, though the buildings have disappeared. Here and there remains of the ivory burnt by Emin were found.

At Gondokoro were found the remains of the old parapets and trenches; also of Baker's gardens, with the lime trees still bearing a plentiful supply of fruit. The foundations of the old Austrian mission chapel we also discovered when excavating to make a brick-kiln. The river had encroached a little on the site of the station, and cut away half the foundations of the chapel. About 16 miles north of Lamogi is Fatiko, with the parapet and ditches of Baker's old fort almost as good as new. The walls of the stone houses, which he described, were still standing.

The natives we found remembered Emin Pasha well, but regarded him with indifference or dislike. He had left, perhaps unavoidably, a great deal of power in the hands of native subordinates, and their abuse of it had made the unfortunate people dread the Pasha's authority. Of Gordon only a few natives seemed to know anything, though most of those living near the river had heard of "Godun," as he was called. I secured one interesting relic of Gordon in the shape of an Austrian bent-wood chair which he had given to the chief Gimorro. I bought it from the latter's son, Aoin, who had fixed a patch of leopard-skin on the seat.

Sir Samuel and Lady Baker, however, seem to have inspired the natives everywhere with the greatest possible affection. They never ceased to tell us wonderful stories of the doings of "Murrdu," or Lion's-mane, as they called Sir Samuel, and of "Anyadue," or Daughter of the Moon, which is their name for Lady Baker. Many of the Bakers' old adherents came to ask us for news of them. Watel Ajus, a very aged man now, got himself carried from his village a long way to my camp. On hearing that Lady Baker was alive in England, he took an elephant's hair necklace from his neck and begged me to give it to her when I went back. This I did, and the old chief was delighted to receive a return present of photographs of Sir Samuel and Lady Baker, with an ivory-handled knife. This he acknowledged by sending back a leopard-skin to Lady Baker. Old Shooli was still very flourishing, and was most useful to the administration. Our best recommendation to the natives we found to be the statement that we belonged to the same nation as Baker, and that our government would be like his. Shooli gave me one of the scarlet shirts which had been worn by Sir Samuel's famous "Forty Thieves." He had treasured it carefully all those years in an earthenware jar, as a sort of credential

to show his connection with Baker. Gimorro was dead, but his son Aoin at once became one of our most trusted native friends.

In all this country the most interesting natural feature is the Nile itself. Emerging from Lake Victoria by the Ripon falls, about 15 feet in height, it sweeps on to Foweira, with, on the average, 400 yards of clear water hemmed in by beds of papyrus on either bank. This part of its course is obstructed only by the low Owen falls and some minor rocky obstacles. It seems probable that steam navigation between Foweira and Lake Victoria can be made possible by a small effort of engineering in constructing locks or blasting a passage through the obstructions. From Foweira to the Murchison falls the case is different. In this part, the river is a succession of rapids, cascades, or falls. The difference of level from Foweira to Fajao in 50 miles is about 1200 feet. The falls, by which the river descends finally from the Uganda-Unyoro plateau through a gap in the eastern escarpment of the Lake Albert rift-valley, are 140 feet in height. Three-quarters of a mile lower down is the site of the now abandoned station of Fajao. At the falls the whole body of the Nile, 150 yards wide and very turbulent, is suddenly contracted into a chasm only 20 feet wide.

RIPON FALLS.

Rushing through this, it makes two jumps into the broad basin below. From the falls the river swirls along through a channel about 100 yards wide, between steep rocky hills covered with green and creeper-festooned trees. At Fajao it commences to widen out into a beautiful pool 500 yards across. In this the water is smooth, and flecked with the broken and snowy masses of froth from the falls. The banks are flat, and covered with tall trees clearly reflected in the water. On every rock and sandbank, and all over the surface of the pool, crocodiles are to be seen in incredible numbers—probably more than in any other single spot in the world. Hippos in the broad pool blow and grunt cheerfully, monkeys chatter at the crocodiles from the trees, a pair of African fish eagles squall in concert, a harnessed antelope creeps out from the trees opposite to nibble the green grass; after dark, a number of spine-winged goatsuckers flit like animated Japanese dragons in all directions, lions may be heard roaring on the north bank, or elephants trumpeting as they come to drink. Day and night the incessant booming of the falls completes a combination of sights and sounds likely to linger a long time in the memory.

From Fajao the river offers no obstacle to navigation all the way to Nimule. There is little doubt that the level of the water alters considerably independently of local storms or rainy weather, which do not affect it much. Time does not permit of discussing this point now. I will merely mention that it was very low in 1898, and continued falling in 1899, 1900, and 1901. We laid out gardens on some ground below the station at Nimule, in 1901. I have since heard that the river has now submerged them, which shows that it must be 6 to 10 feet higher than in 1901. When the river is low, boats drawing 3 feet of water might have difficulty in passing some of the sand-bars—one, for instance, at the southern end of Lake Rube. Just where the river enters Lake Albert a great extent of papyrus and sudd blocks the exit, though there are numerous channels through it. Again, between Wadelai and Nimule huge beds of papyrus and accumulations of sudd are met with, though generally the passage is easy enough to find. The river varies in width from 200 yards in places to a mile or two.

Lake Albert is a beautiful sheet of water. A splendid view of it is obtainable from the top of the escarpment just above Kibero—1200 feet above the lake. On the opposite side, 60 miles away, rise the steep mountains of the Nile-Congo watershed, 6000 and more feet in height. All the way along, waterfalls and cascades can be seen flashing through the dark-green covering of the mountain slopes. Away to the north can be seen the depression where the White Nile makes its exit and starts on its long journey to the Mediterranean. To the south can be seen the low swampy land at the mouth of the Semliki. Beyond this haze and cloud usually hide the huge hulk of Ruwenzori, with its snow-clad peaks, but in clear weather the spectacle is one not to be forgotten.

At Nimule the Nile passes through a narrow defile and again contracts in an extraordinary manner. There are first a series of slight rapids, and then, 2 miles from Nimule, the river rushes through the gorge of the Fola rapids about 20 yards wide and a quarter of a mile long. For the next 20 miles the fall is rapid, and rocks and islands obstruct the course of the river. The scenery about this part is very striking and worth going a long way to see.

From this on down to the Bedden rapids the river is only slightly obstructed here and there by rocks in the bed. The Bedden rapids themselves are only a few feet in height, and a little engineering would enable steamers to come right up to the mouth of the Assua river.

MURCHISON FALLS.

If this were done, nothing but the rapids in the Fola defile would prevent boats coming all the way from the Mediterranean to Lake Albert. A piece of railway 20 miles in length would suffice to link up the two stretches of navigable water on each side of the defile.

It is impossible, in the limits of this paper, to do more than cast a speculative glance at the possibility of utilizing the immense amount of power available in the falls and rapids of the Nile within the limits of the Uganda Protectorate. The discharge of the Nile is between 530 and 2300 cms. per second according to Sir William Garstin. In a country without coal, so far as is at present known, the utilization of this power for the proper development of resources may soon become a practical question, especially as the transmission of electric power to a distance is now being effected with constantly increasing economy.

The affluents of the Nile on the right bank are all periodical streams without exception. Even the Assua, which at times is a brown flood 120 yards wide and 20 feet deep, may be crossed at the dry season without wetting one's feet.

Speaking generally, the Nile province may be described as the floor of a valley sloping gradually up from the river to a height of between 3000 and 4000 feet above the sea, at a distance of 60 to 80 miles east of the river. It is gently undulating, and well intersected with streams. Only in the Lango country, between the Nile and the Assua, do these become extensive swamps, like those of Uganda. Curious isolated granite hills occur in the central portions. A very regular double chain of them encloses the double valley of the Unyame and Ayuge. Others are to be found in the Lango country, and others again in the Bari country, such as Belinian, Rejaf, etc.—isolated hills forming very conspicuous landmarks. On the left bank the escarpment recedes some distance from the river after it leaves Lake Albert, but closes in again with the fine group of mountains opposite Nimule. These culminate in the sharp peaks of Otze and Elengua, rising 3000 feet above the river and, with the group of syenite hills opposite, form the Fola defile.

The Nile province generally is looked upon as the most unhealthy part of the Uganda protectorate. But apart from malaria one may say that there was practically no disease among the Europeans.

The largest tribe in extent of distribution is the Acholi, which covers the greater part of the country between the Latuka mountains and the Victoria Nile. They extend westwards, and gradually merge into the Lango and Karamojon, with whose language and physique theirs have much in common. They are a fine, tall, well-built race, and they live in open villages as a rule; their arms are chiefly spears, and they spend a good deal of their time in the pursuit of game; they practically wear no clothes at all, except a small piece of skin as an apron, or hung over one shoulder. Married women wear a peculiar tail made of string, and sometimes a small apron made of beads. The men and women also are fond of wearing a crystal or glass spike, about 3 inches long, in the lower lip. Young men are generally very smartly turned out, wearing brightly polished metal rings on their arms and legs, also a peculiar little conical cap made of felted human hair, ornamented with beads of glass or ivory. They keep their weapons in good order, and always keep themselves very clean and well oiled.

A peculiar custom in their villages is the building of a common nursery, into which all the small children are stuffed at night, the small door being closed with a whisp of hay or piece of basketwork. These nurseries are usually raised above the ground, and are reached with a ladder, so as to be beyond the reach of hyenas. A similar arrangement on a somewhat larger scale is made for the young unmarried girls. The huts are beehive-shaped, generally very neatly and

carefully built, with flounced thatching very well arranged; the huts are frequently ornamented with some device on the pointed top, or an ostrich egg. The doorways are low, and have to be entered on the hands and knees, and there are no windows. Inside, the hut is divided into portions for the storing of food, for goats, for a fireplace, a place for grinding corn, and a sleeping-place, usually raised. Around the walls they arrange large earthenware vessels, in which they preserve their valuable or destructible possessions. They ornament the walls of their houses with quaint drawings of animals, men, etc.

They are very fond of dances, and these are very picturesque; they

THE FOLA RAPIDS.
(*From a photograph by Dr. Hodges.*)

have a variety of figures representing all sorts of scenes, and dress themselves up to represent animals, etc. They make, in years of good harvest, a lot of beer—and drink it too, though it does not seem to do them much harm. They do a good deal of cultivation, and, though fond of fighting and of excitement, they are really an amenable people and give the administration no trouble. I may say that all the natives in the Nile Province are, now that they have confidence in us, very charming people to deal with.

The Lango are a wilder and less organized tribe than the Acholi; the young warriors wear very handsome headdresses made of cock's feathers, which resemble a guardsman's bearskin at a short distance. Another

peculiar habit of the Lango is to pierce the tongue and hang a little piece of brass chain to the tip. This is the highest effort of fashion.

In the angle formed by the river where it enters and comes out of Lake Albert Edward, and along its bank as far as Wadelai, but only on the river-banks, are found the Alur. The bulk of this tribe lives on the opposite side of the river and of Lake Albert. They live chiefly on fish and occasional hippopotami or crocodiles, but they also cultivate a certain amount of cereals and beans. They resemble the Acholi in appearance, though they are not such a fine race, and are more addicted to the use of the bow and arrow than the spear.

In the corner of Unyoro, called Magungo, a very peculiar tribe is to be found which well merits examination by an anthropologist. It differs in many particulars from the tribes surrounding it. Mr. George Wilson told me that he had heard these people had a tradition resembling the story of the children of Israel and their miraculous passage of the Red sea. On inquiry among them I found this was so, the Red sea in this case being represented by Lake Albert, across which, they stated, the bulk of their tribe had escaped oppression in Unyoro by the waters opening and leaving a passage.

From Wadelai down the river on the right bank is to be found the Madi tribe. These also extend only a very short way inland from the river, and live along its banks like the Alur. They affect circular villages with parapets and ditches, often a stockade in addition, with a few narrow gateways. Their arms are spears and bows and arrows, and they live much in the same way as the Alur; their language, however, is totally distinct from that of the Acholi, and their physical characteristics differ considerably: they are a much sturdier, stouter-built race, and darker in colour than the Acholi. They extend down the Nile for some distance beyond Nimule.

North of the Madi again come the Bari, between the Nile and the Latuka mountains—another perfectly distinct tribe. Physically, these resemble the Acholi; their language is different, however; they are not so clean, do not build such good houses, and do not pursue game, or only rarely. The Bari extend north of Gondokoro, and are now a very quiet and friendly tribe, giving the administration no trouble.

The whole of the Acholi country is covered for eight months in the year with grass 6 to 9 feet high, which is burnt in December, and from then till April the whole country is open—all the game can be seen, and travelling is delightful. The greater part of the country is also sprinkled with small acacia and other trees, and studded with ant-hills. In some parts the predominating trees are borassus palms; in others kuk thorns, or again, kigelia, or again, tall butternut trees. Patches of really fine forest are rare in the country, though proper afforestation and the prevention of grass fires would no doubt give excellent results. Between the Assua river and the southern end of the Latuka mountains

occurs a very large extent of dense bamboo jungle much frequented by herds of elephants. The Bari country is to a large extent open grass land with splendid large single trees studded about it, giving it a very park-like appearance.

The Lango country lies between the upper course of the Assua river and the Nile. The southern slopes from the watershed, which is quite near the Assua river, are very flat, with swamps in every stream bed, frequently a mile or two wide, and when full too deep to wade across. In the dry season the swamps disappear—even the Toshi and Kokolle rivers nearly run dry. The country to the north of the Aswa is drier, rain often fails, grass is shorter, and dry-country animals, such as zebras, ostriches, donkeys, etc., abound. The Aswa river dwindles in size to the east in a surprising manner, and it is rather difficult to realize that it comes from the Karamojon range, though this must be the case. I may mention that Lieut. Howard, who marched from Sabe, north of Mount Elgon, to join the Longo Field Force in May, 1901, informed me that he did not come across any lake or sheet of water which might correspond to the Lake Kwania, tentatively indicated in Colonel Macdonald's survey.

Throughout the Nile province red dhurra is cultivated; telebun, dukhn, Indian corn, semsem, tobacco, ground-nuts, and sweet potatoes are largely grown. Bananas are only found in one or two of the Alur settlements. This is singular, as throughout Unyoro they are grown everywhere. Round the stations we found that many European vegetables grew very well, also papai. Near the sites of Emin Pasha's old station many plants of cotton run wild were found. These showed pods well filled with long staple cotton, which would lead one to suppose that cotton might be profitably grown; the chief obstacle to cultivation in the western part of the Nile province, and especially in the Bari country, is the frequent lack of rain, but in time to come irrigation works from the Nile will perhaps remedy this. Cattle used to be kept in enormous numbers by the natives throughout the country. Sir Samuel Baker mentions villages possessing herds of from 6000 to 10,000. Rinderpest and inter-clan fighting have combined to keep down the numbers. The preventable causes removed, and provided no more natural scourges visit the country, there should be a great future in the Nile provinces for the cattle industry.

Of wild animals elephants take the first place; there are enormous herds of them, especially in the northern part, and the ivory is of the greatest size. A big herd wanders down from the flanks of Elgon, and uses a remarkable elephant road, which is apparently used only during the season of migration; it comes from the east through Lira, crosses the Assua, and so on to the Acholi country. This herd of elephants frequently crosses the Nile at the southern end of the lake-like extension near Wadelai.

Hippopotami come next in size, and are to be found in countless numbers in the Nile. When the tributary rivers are in flood they go a long way up them. Were it not for the fact that in the Nile they are extremely dangerous and cause considerable loss of life, they might well be preserved, for they do little other harm—a very small fence is sufficient to keep them out of cultivation.

Rhinoceroses occur throughout the Nile province in small numbers; they are most numerous, perhaps, in the country east of the Gondokoro. Giraffes are fairly numerous. They wander all over the Acholi country, and have been seen in the Lango country, and also in the Bari country near Gondokoro.

Of eland, I only saw one small herd near Nimule. Buffalo were almost exterminated by a visitation of rinderpest 15 years ago, but several herds now are beginning to increase rapidly. Baker's roan antelope are to be found north of the Assua river. Jackson's hartebeest is common, and north of Gondokoro, the area of the *Damaliscus Senegalensis* commences. *Kobus defassa* is fairly common throughout the Nile province. *Kobus Thomasi* is common in the Acholi country, and along the Nile near Gondokoro. Just north of Gondokoro appears to be the meeting-place of the *Kobus leucotis* and *Kobus Thomasi*; both were to be seen in the same valley, but the *Leucotis* did not extend south, nor the *Thomasi* north of the line. Some specimens were seen suggesting the idea that the two species interbreed. Reed-buck are to be found in the Acholi country, and also, but rarely, bush-buck and harnessed antelope. Wart-hog are found occasionally everywhere, and I heard from the natives of a very large variety of pig called by the Acholi "Labala"—of this animal I unfortunately never saw a specimen. Lions and leopards are fairly common in the open game country. Hyenas are, on the whole, rare; wild dogs (*Lycaon pictus*) are found, though rare, and so are jackals; serval cats are common; puff-adders and the black-necked cobra are the commonest snakes, though in the Lango country pythons must be numerous, judging from the number of drums we found with the drumheads made of their skin. Ostriches and zebras occur in the north of Lira, and are said to be common to the east of the Latuka mountains.

The rainy season, I believe, normally commences in April, though during the time I was on the Nile, it hardly rained at all except during the last year. In normal seasons it rains for about two months, and should recommence about September, but the second rains are not so heavy as the first.

The Nile provinces are considerably warmer than Uganda, in consequence of the general elevation being 2000 feet lower. It is sometimes very hot in the valley of the river, and at Gondokoro the temperature occasionally exceeds 100°; but, speaking generally, the country cannot be called hot in the sense of the hot weather of India.

Later on, when the development of the administration will enable the stations to be placed further east on higher ground, delightfully cool and healthy sites will be available; in the Latuka country, for instance, the mountains reach a height of 9000 feet above the sea.

The communications in the Nile provinces were somewhat primitive, but are being improved now. In 1899–1900 the natives, by my orders, cleared a broad road all the way from Fajao to Gondokoro, and another from Wadelai to Nimule, *viâ* Lamogi. But these roads require constant looking after, as they get easily overgrown. A launch and a large steel boat now run between Lake Albert and Nimule; a telegraph line is being carried towards Gondokoro. There are several points between Foweira and Lake Albert where a comparatively short bridge could be built across the Nile. Bridges about 150 yards long would be required over the Assua, Khor Gana, Khor Kit, and shorter ones for the other streams.

There is no serious engineering obstacle to the construction of a railway either along the Nile bank or a little further inland, and there would be still less in carrying the line through the swampy plains from Gondokoro all the way to Fashoda. If Sir William Garstin's magnificent scheme for canalizing the Nile between Bor and Fashoda is ever carried out, the waterway for steamers would be immensely improved, a splendid embankment for the railway would be provided, and, lastly, many millions of acres of good soil would be reclaimed from the swamps—and all this apart from the chief object of the scheme, which is to largely increase the water-supply for Egypt.

The anthropology, ethnology, and languages of the Nile tribes, all offer subjects of study of the greatest interest. I compiled a glossary of about a thousand Acholi words, but time was lacking to do more. Now that the Church Missionary Society are starting stations in the province, it is to be hoped that these tribes will be exhaustively studied.

II. The Anglo-German Boundary Commission west of the Victoria Nyanza.

In July, 1902, after a short leave in England, I returned to Mombasa for the purpose of commencing the work of the Anglo-German Boundary Commission west of Lake Victoria. My companions on this occasion were Major Bright and Lieut. Behrens. In East Africa we were joined by Captain Harman. Captain Laughlin and Sergeant-Major Rehm also joined the commission for a short time. Dr. Bagshawe was in medical charge, and at my request undertook the botanical collection. Colonel Hayes Sadler, H.M. Commissioner for the Uganda Protectorate, also lent me the services of Mr. Doggett as taxidermist and collector.

The German commission consisted of Captain Schlobach and

Lieutenants Schwartz and Weiss. In addition, the German commission had Feldwebel Buchner—a first-rate surveyor—and a civilian geodetic technician, besides a sergeant in charge of the office. It would be difficult to find more agreeable comrades than our colleagues of the German commission, and the personal relations between the members of the two commissions were always of the happiest.

The task before the commissions was to carry the longitude from the coast to the west side of Lake Victoria, and then to survey topographically a strip of territory between the lake and the Congo Free State boundary, along the 1st parallel south latitude, sufficiently wide to enable a readjustment of the conventional boundary to be discussed. As a starting-point on the coast, Ras Kadamoni, on the mainland opposite Mombasa town, was indicated, and the Admiralty values for the latitude and longitude of this spot were accepted by both Governments.

On our arrival at Mombasa, we found that, owing to a misunderstanding, Captain Schlobach had gone right up to the western end of the boundary, on the Congo Free State border, instead of meeting us at the coast. Telegrams were sent after him, and he returned to Entebbe.

A few days were spent at Mombasa in making a small base and triangulation to connect Ras Kadamoni with the temporary observatory on the railway station platform at Mombasa, on the island where the end of the telegraph was, disembarking stores, only a portion of which had come out with us, and in enlisting porters. The latter proceeding offered no difficulty, as hundreds of men who had served with me before on the Nile and elsewhere offered themselves; the difficulty lay in the selection. In the end a splendid body of men was got together.

I then started for Entebbe, with Lieut. Behrens and one hundred porters. We reached the lake in two days by train—a contrast to the three months' journey it used to be. In two days more we were at Entebbe by steamer, and found Captain Schlobach and the German commission.

Our original instructions were to the effect that the longitude of Entebbe was to be determined by exchanges of telegraphic signals with Mombasa. Accordingly, the German commission left for the coast to work at Mombasa, while we remained at Entebbe. We worked night after night, but it was found impossible to get signals through on the section Port Florence—Entebbe. The line was in every way unsuitable. Originally only a telephone line, it was incompletely insulated. Earth currents continually affected the wire. Every thunderstorm in the neighbourhood, also, and an incessant crackling in the instrument, indicated lighting somewhere on the line. Besides this, white ants destroyed the poles; tall grass grew up over the wires; trees drooped their branches on to it, or the poles took root and enclosed the wire in bushy growths; cattle and wild animals upset the poles when rotten;

grass fires damaged both the poles and the wire; finally, an elephant went off with half a mile of the wire round his neck, eventually strangling himself after a terrified flight through Usoga. The dead body was found 40 miles from the line by some natives. We therefore had to give up this bit of the line, and we proceeded to make the exchanges over the Mombasa—Port Florence permanent line.

To save time, I hired a launch for the trip to Port Florence from Entebbe. As luck would have it, the engines broke down in the open lake. We fortunately got them to work again in a couple of hours, and just ran in to the opening of Kavirondo bay as a terrific storm came on. During the night we ran ashore some miles south of Port Florence, but got there safely in the end.

Two complete series of exchanges were made with the British commission at Port Florence, and then the commissions changed ends to repeat the process. By this means the effect of personal error was eliminated. In the end the longitude of Port Florence was determined with a very small probable error. The work was subjected to most tiresome delays. During September it was possible to make exchanges on two nights only, and on both these nights the complete programme was carried out. During October exchanges were possible, so far as the weather was concerned, on the nights of the 7th, 9th, 18th, 20th, 21st, and 28th. On the 18th and 28th the programmes were successfully carried out; on the 7th and 21st the results were spoilt by interruptions of the telegraphic communications; on the 9th, by an accident to the instrument at Mombasa during the time observations; on the 20th, by the telegraph clerk going to sleep and failing to give the call from Port Florence.

The weather throughout was particularly unfortunate—the rainfall during September and October was unusually heavy, and so it continued during the subsequent work. The actual figures were for October, 10·30 inches of rain in fifteen days, as compared with an average of 2·37 for this month during the ten years from 1891–1901. The rainfall in September was equally abnormal. The two stations where the astronomical observations had to be carried out were most unfavourably situated as regards the meteorological conditions. Mombasa is on the sea-coast, and the drift of monsoon clouds from the south-west was almost incessant. The occasions when observations were made can only be regarded as corresponding to larger gaps than usual in the cloudy pall. At Port Florence the mornings were generally very bright and clear, but towards evening the clouds rolled down towards the lake from the Mau plateau in the east, culminating, as a rule, in a violent storm about sunset, and covering the sky with dense masses till dawn, when it would clear, and the sky remain almost cloudless till noon. The incessant watching and waiting at night—for whenever a glimpse of stars could be seen observations were taken on the chance

of turning out useful, or for latitude, or to rate the chronometer—and the equally continuous work all day were trying to both commissions; it had to be proceeded with, though, because an opportunity lost might have meant weeks of further waiting. But every one found that odd hours of sleep snatched in the daytime were, in the long run, a poor substitute for regular nights' rest.

During September the missing baggage and instruments arrived at last, but even then we did not get them without accident. Some boxes were dropped into the sea while being landed at Mombasa, and then the baggage-train coming up-country turned over and rolled down an embankment. The goods were put on another train, which did just the same thing. Our baggage did not suffer much, luckily, but an unfortunate horse died from being left upside down for two days in a horse-box. The line has much improved since then, and trains run up steadily and well now.

As the wire between Port Florence and Entebbe was useless, a provisional determination, by transport of chronometers, of the difference in longitude was made by one officer from each commission. The bulk of the two commissions commenced a triangulation from Entebbe to the mouth of the Kagera river. This was interrupted by dense haze, and, after waiting for some time, we gave it up temporarily, and moved on to our base camps at Mizinda to measure the base and make the observations for latitude and longitude, and to commence the survey along the 1st parallel S. latitude. To assist in the triangulation, I had obtained the loan of a party of signallers with heliographs from the Indian battalion of the King's African Rifles, and this party proved most useful all the time they were with us.

A base very well laid out by the German party near Mizinda, 6954·196 feet in length, was very carefully measured by both parties, and an extension observed. Latitude and azimuth observations were made at Mizinda. This work was all delayed by haze, but by the middle of January we moved, with every available theodolite in both commissions, to reoccupy the triangulation stations and complete the portions between Entebbe and Mizinda. This had almost been accomplished when the haze descended again, stopping observations for another twenty-three days. During this time a long cutting through dense virgin forest had to be made to allow two triangulation stations to be mutually visible. The line was laid out on a bearing, and the work continued day after day. The ground undulated through the forest, streams had to be crossed, and it was never possible to see far forward or back. It was, therefore, a great relief, when the haze lifted, to see the beacon appear, and exactly opposite the centre of the opening.

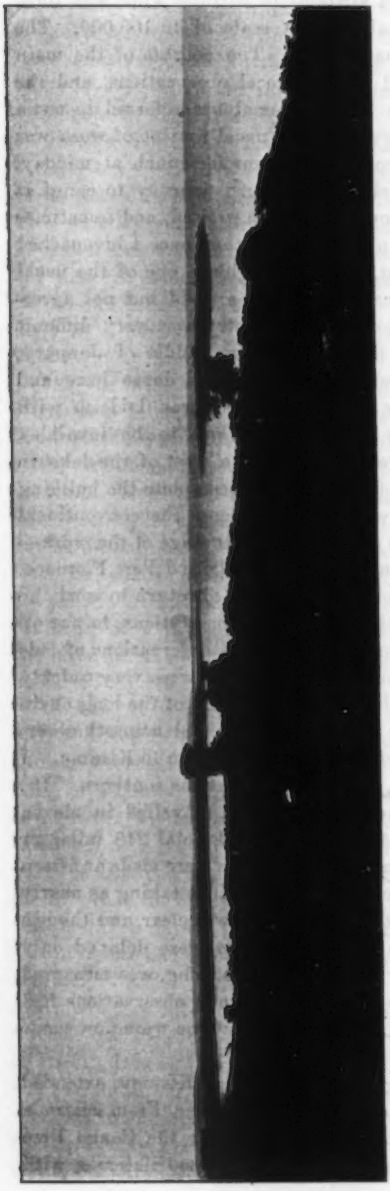
Both commissions carried independent triangulations from Mizinda to the Congo Free State boundary. The British triangulation north of the 1st parallel was laid out in quadrilaterals all the way, and closed

on to a base 8658·5 feet long at the west end. A large number of secondary points was fixed, and a strip 20′ in latitude wide was topographically surveyed on plane-tables on a scale of 1 : 100,000. The area amounted to about 3000 square miles. The heights of the main triangulation stations were fixed by reciprocal observations, and the detail of the features was shown by sketch-contours referred to mean sea-level at 100-feet vertical intervals. The usual routine of work was to start out at daybreak, stop work for an hour for lunch at midday, and then go on working till dark. The return journey to camp at night was often rather difficult over the rough ground, and sometimes I did not get in till ten or eleven o'clock. More than once I bivouacked for part or the whole of the night. To be caught in one of the usual terrific thunderstorms on these occasions leaves a vivid but not agreeable impression. A large portion of the country was very difficult to survey, but the work was finished by the middle of January, 1904. Delay had been occasioned by the periodical dense haze and by rain on 139 days. Also by the fact that I was laid up with fever for two months, and that Major Bright had to be invalided to Entebbe. Both commissions returned from the west of the lake in January, 1904, leaving each an officer behind to complete the building of the boundary pillars, which were put up along the conventional boundary. We then proceeded to carry out the last stage of the work—the completion of the triangulation between Entebbe and Port Florence.

When Major Bright had sufficiently recovered to return to work, he was sent on from Entebbe to select the triangulation stations, to put up beacons at all of them. The result was that the observations of this portion of the triangulation laid out in quadrilaterals were very quickly made. We stopped on Buvuma island, near the centre of the long chain of triangulations, for three weeks to make latitude and azimuth observations, and then brought the triangulation straight in to Kisumu. I took the northern line of stations, and Major Bright the southern. Dr. Bagshawe accompanied the northern party, which travelled in eleven days 72½ miles by canoe and 145½ miles by land, total 218 miles, or 20 miles per day. During this time my observations were made at fifteen different triangulation stations, each set of observations taking as nearly as possible three hours to complete. The weather was clear, and though it often rained, it was lucky that the observations were delayed only once by rain. At Kisumu another base, 5476·78 feet long, was measured and connected up with the triangulation. Latitude observations had been made at Port Florence, and azimuth observations were now made at Kisumu.

Thus a triangulation, starting from the base at Kisumu, extended all the way to Mizinda, closing on to the base there. From Mizinda another triangulation extended to a third base near the Congo Free State border. Both triangulations were laid out in quadrilaterals, with

sides of from 10 to 30 miles. The triangular errors were dealt with by Clarke's method of least squares, and the final computation showed the first triangulation, 260 miles long, to close on the Mizinda base with a discrepancy of only 2·97 feet, and the second triangulation, of 130 miles, to close on the base in the west, with a discrepancy of less than 5 inches. The three sets of latitude and azimuth observations were combined by the triangulation, and give a good mean result.



MIZINDA HARBOUR.

The ends of the bases at Mizinda and near the Congo Free State boundary have been permanently marked, as well as all the main triangulation stations between these points. The remaining triangulation stations will be marked by the Uganda and East African Protectorate administrations. They will thus be available for the extension of future surveys.

The harbour at Mizinda is of especial importance, as it is the only harbour on the west side of Lake Victoria within British territory. It is formed by the indentation of the coast-line known as Kabanyaga bay, which is completely protected to the eastward by Busungwe island. The northern entrance is narrowed by the fan-shaped bar thrown out

by the Kagera river at its mouth. This bar reduces the entrance of the harbour to a narrow width of deep water, and is an effective protection against the gales from the north-east. As the water is only from 3 feet to 4 feet deep over it, the seas rolling in from the lake break up on the bar. The southern entrance is also narrow, with deep water. Mizinda point, projecting slightly into the harbour, further improves the protection, and a pier run out at this point would enable steamers to come alongside without difficulty. The gales from east and south-east, coming from the open lake, are extremely violent on this coast. For the security of shipping on the lake, a good harbour is of the utmost importance. All the requisite conditions are amply fulfilled by Mizinda harbour.

The lake-shore north of Point Chiasimbi is very swampy, and impracticable for landing except at the mouth of the Bukora river. This river, coming from the small lakes in Ankole, is choked with papyrus and reeds throughout its length, but can be navigated in canoes through certain winding channels. Near the mouth are a landing-stage and a canoe ferry to the other bank. From just south of Chiasimbi point to the mouth of the Kagera river extends a beautiful beach of white sand resembling that of the sea, backed with parklike country, with woods and groups of fine trees. At Mizinda point a sharp projection of rocky ground occurs, forming a cliff about 150 feet in height on the eastern edge. Busungwe island, on the eastern side of the harbour, is rocky, uninhabited, and partially covered with vegetation and groups of trees. From Mizinda point southwards extends another long white sandy beach as far as the mouth of Luanyega bay, which forms another splendid harbour, but within German territory. From here southwards towards Bukoba, the lake-shore consists of steep rocky headlands with small indentations. Here and there only can sufficient shelter for canoes be found.

(*To be continued.*)

THE FRENCH ANTARCTIC EXPEDITION.*

By Dr. JEAN CHARCOT.

I AM fully sensible of the honour conferred on me by the Royal Geographical Society—an institution so universally and justly esteemed—in asking me to read before it a paper on the French Antarctic Expedition. I look on this honour, not so much as a deference paid to the expedition itself and its results, as to the efforts made to secure them. No possible comparison can be made between our little excursion and the great and brilliant English expeditions, and it is not

* Read at the Royal Geographical Society, June 26, 1905. Map, p. 592.

without a certain trepidation that I venture to address you on our achievements within a few months of the return of the *Discovery* and the *Scotia*. Nevertheless, I have not hesitated to accept the opportunity offered me, knowing that you will make every allowance for our shortcomings, and take into consideration the great material difficulties that we have had to overcome.

In our country, which yields to none where there is question of explorations in Africa, in Asia, and in South America, polar expeditions had been neglected; hence even the present undertaking was favourably received only by a very small circle. It had, moreover, to be prepared somewhat hastily, and that with extremely limited means, especially at the moment of departure. I hope that in future matters will be arranged quite differently, and that henceforth France will take her part with the other great nations in the peaceful struggle against the unknown. Such co-operation cannot but tend to draw closer the ties between peoples that should be animated by feelings of mutual esteem and friendship.

Owing to the limited means at our disposal, the programme adopted by me was correspondingly modest, for I went on the principle that it would be better to employ all our resources in thoroughly exploring a narrow corner, and thus securing trustworthy documents with accurate observations, than wandering listlessly up and down the seas, exhausting our efforts in haphazard researches which might prove more satisfactory to our vanity, but would assuredly have been far less useful to science.

You will easily understand me, when I say that it is impossible to give you the exact fruits of our mission within scarcely a fortnight of our return. Our packages, with notes, documents, and collections, have not yet been opened, and the fortnight has been almost entirely occupied by me in visits and in taking the steps which were required after such a long absence, and have been almost as tiring as the preparations for the expedition, certainly more so than the expedition itself. Many long months will be needed to arrange all my scientific observations, years almost to classify and study the collections, and, even as regards the geographical studies and discoveries, I think it would be premature to give results that cannot claim finality until we have carefully gone over our notes and observations, and looked up and studied all the original charts of previous expeditions in the same regions, since it seems to us that these charts will have to be considerably enlarged and modified by our researches. Hence I hasten to assure you that the chart which you have now before you must not be considered as anything more than a mere sketch, hurriedly drawn to enable you to follow the various sections of our voyage. I think I may claim that, thanks to my associates' zeal and competency, the scientific documents brought back by us are not inconsiderable. But it will be for the savants who may have to examine them to give their opinion on their value.

I will accordingly here give you a mere summary of our labours. As for our account of the life itself of the expedition, I would ask a public accustomed to the story of the great polar epopees to excuse me for dwelling a little on that aspect of the subject. I have to state with almost a sense of shame that, owing to circumstances quite beyond my control, we had to set out without a single person experienced in the navigation of ice-fields, so that you may be interested in knowing how we managed to get through at all. Necessity is the mother of invention, and we may sometimes learn something from the shifts to which the ignorant are driven when forced to struggle through

PANORAMA OF WANDEL, WITH THE BAY WHERE THE "FRANÇAIS" WINTERED.

difficulties without the aid of precedents of which they have no knowledge.

Our general programme was to survey the north-west coast of the Palmer archipelago (Haseau, Liège, Brabant, Antwerp islands); to study the south-west entrance to the Gerlache strait; to search for a land wintering station in that region as far south as was possible with the state of the pack-ice; to make excursions in spring, and in summer to continue the exploration of Graham Land, with a view especially to elucidating the question of the Bismarck strait, and following this coast as far as Alexander I. Land. During the whole of this campaign we had to occupy ourselves with the various operations for which the expedition had been equipped. In a word, we had to continue and complete the labours of the Gerlache and Nordenskjöld expeditions.

To carry out this programme, I had built at St. Malo a small ship of 245 tons, well fitted for the work it had to do. Built entirely of oak, strength was the first consideration; the berths were well protected against cold, and special care was taken to provide proper accommodation for the laboratory, chart-room, and other installations. Thanks to its build, the ship was quite seaworthy and well suited for navigating the ice-fields. Unfortunately the engine, the best we could get for our money, was not strong enough for the work to be done, and its defects had to be made good by the skill and energy of men and officers. The navigating and scientific instruments, partly bought by me, partly lent by the Government or given by private persons, proved entirely satisfactory. I took special care with the clothing, provisions, and supplies of all sorts; and I may say that in these respects few, if any, expeditions have been better equipped than ours. The provisions were abundant, greatly varied, and of prime quality, partly prepared in France under our inspection, while certain specialities were procured in Germany, England, and the United States.

Our staff comprised six unpaid officers, and the crew fourteen men, including five sailors, three stokers, a cook, and a steward, all French except one Italian—an Alpine guide. Of the staff, M. A. Matha had charge of the hydrographic department—astronomic observations, chronometers, study of tides and currents, density and salinity of the marine waters, and terrestrial gravitation; Mr. J. Rey, of meteorology, terrestrial magnetism, and atmospheric electricity; M. P. Pléneau, of photography; Dr. J. Turquet, of zoology and botany; M. E. Gaurdon, of geology and glacial phenomena; Dr. J. B. Charcot, of bacteriology; and the captain of the *Français*, medical duties.

We sailed from Havre on August 15, 1903, and after a series of mishaps reached Buenos Ayres on November 16. For the warm reception received from the Argentine Republic, both on our arrival and return, I shall always have to speak in terms of the deepest gratitude. Nothing could exceed its generous welcome, and the accomplishment of our task is certainly in great measure due to the Argentine people. At Buenos Ayres we were lucky to meet Nordenskjöld, to whom we submitted our programme, which met with his approval. Then, a few days before our departure, we made the acquaintance of the worthy Mr. Bruce on his return from the first part of his interesting expedition. We left Buenos Ayres on December 23, and after stopping a few hours at New Year's island to pick up the five dogs lent us by the Argentine Republic, we reached Ushwaya, where an Argentine transport, driven from its route, brought our coal and our last despatches.

On January 26 we touched at Orange bay, the point where the French mission of the *Arromanche* passed a whole year (1882–83), and carried out those interesting works known to you. After taking some

observations ashore and making sundry researches, we set sail on January 27.

After a fairly smooth passage despite two days of high gales, we landed at Smith island (South Shetlands) on February 1, and here came upon our first icebergs. Then we made for Low island, passing the site of the Williams reef, which we may almost say has no existence, since on our return we again passed the same spot without seeing it, though the weather was quite clear on both occasions.

I find it impossible to give you the substance of my log-book without mentioning at least the chief names of my precursors in the regions we are now about to enter.

In 1819–21, Alexander I. Land was discovered by Bellingshausen. Foster (1828–29) was followed by the remarkable expedition of Biscoe (1832), to whom belongs by right all the west coast of Graham Land. Our countryman, Dumont d'Urville (1837–40), led the way for the German whaler Dallmann (1873–74), who reported the strait by him named Bismarck, besides various other points in the Palmer archipelago. In 1893–94, thanks to quite exceptionally favourable weather in the month of November, the whalers Evensen and Pedersen were able to approach nearer to Alexander I. Land than any other navigator. Lastly, in 1897–99, the well-conducted Belgian expedition under Gerlache marks an era in Antarctic expeditions, distinguished by the discovery of Gerlache strait and the leader's first wintering station.

On February 2, 3, 4, 5 we coasted the north-west side of Palmer archipelago, and made a rough survey of its hydrography. During those four days we were greatly impeded by snow-storms and fogs, and especially by troubles with our boiler. Numerous Balænopteræ were met. On the 6th, continuing the same course, and passing many reefs and icebergs, we entered Biscoe bay, and during the night anchored off Cape Errera. On the 7th, making our way in splendid weather through numerous floes, we reached Flanders bay, but could find neither anchorage nor shelter, its shores being covered with a thick fringe of ice. We then made for Lemaire channel, but were baffled by the winds and floes, and had to return to Flanders bay, where we managed to moor the ship to the banquise (ice-fringe) by means of the ice-anchors. Here we remained eleven days, repairing the condenser and boiler, and making a few short excursions round about.

On the 19th we set sail and went in search of a good site for erecting a cairn on Wincke island. Next day we found a suitable position in the Neumayer channel, where we raised the cairn, and not far off passed the night in a little inlet with good anchorage, close to a rookery of penguins. This place, being too sheltered, would be of no use for taking observations during the winter.

On the 21st we entered the Lemaire channel, which, however, we found blocked with ice in the latitude of the southern extremity of

Wandel. We then tried to turn this island, but after passing it found ourselves again ice-bound, and had to return, anchoring in a little cove which we had noticed when passing.

On the 22nd we again essayed to advance southwards, and reached an eminence amid the floes and reefs, from the summit of which we clearly saw that no advance was then possible in that direction. So we returned to Wandel, where we remained two days patching up the boilers. Starting on the 25th in search of the Biscoe islands, we forced our way through the ice, and by nightfall reached the relatively open sea. On the 26th we again encountered a banquise near Pitt island, and tried to penetrate through the ice to the neighbouring islands.

On the 27th, our efforts to make Graham Land being thwarted by the increasing thickness of the ice, and finding no shelter under the cliffs, we had to retrace our steps, and next day again doubled Pitt island. But here, being struck by a fierce squall from the north-east, we had to remain four days at the north-east cape, enveloped in snows and fogs and beset by icebergs.

On March 3rd the fogs lifted, and, a calm setting in, we again made Wandel island, anchoring in the old inlet. The season being now advanced, and all our efforts having failed to find another shelter, we decided to pass the winter in this haven, which abounds in seals, cormorants, and penguins, and is well sheltered from all points except perhaps the north-east. Here, also, we could easily land and set up all the structure needed for our operations, and for our safety in case of any damage to the ship.

I had one of the anchor chains drawn across the inlet and made fast to the rocks on both sides in order to stop the drifting ice, and this in its turn served as a breakwater against the northern winds. The ship, which was thus thoroughly protected, had some 6 or 7 feet of water at its prow, and over 20 at the stern, so that there was nothing to fear from the large icebergs.

We at once set to work with our winter installations, fixing our portable house, and in the ice close by excavating two large stores roofed with shingles and canvas. Here we stowed the provisions, and constructed two Eskimo snow-houses, which also served to keep meat and a reserve stock of seal, which was largely consumed both by the men and exclusively by the dogs. The large whale-boat reversed afforded shelter to the petroleum casks, and the smaller boats were kept ready to be launched at a moment's notice for excursions and fishing.

Two structures, one in stone and canvas-roofed, the other in wood with copper riveting, both provided with plastered sandstone pillars and covered with marble slabs, served for magnetic observations. Another pillar, enclosed in a tent, was intended for observations with the quadrant or sextant. Corresponding arrangements were made on board, and the chain drawn across the inlet was so firmly fixed that it successfully

resisted the attacks of the ice drifting against it in the form of floes and even little icebergs piled up to an incredible size. Still the swell driving before the fierce north-easters at times caused not a little anxiety, especially for the safety of the ship. But it was soon found that, thanks to the trend of the current, the lightest southern breeze, and even a mere calm, sufficed to clear the inlet of the accumulated ice, however thick it might be, except in the month of July. We were surrounded with ice formed on the spot, and, in the spring, with floes and the *débris* of icebergs which had accumulated and become cemented together over a large area. I consider that, if a vessel were minded to winter again at Wandel, it would be in perfect safety if it took the

THE HOUSE LEFT BEHIND AT WANDEL.

same precautions as we did. It would need to be provided with a powerful wire hawser or chain cable fitted with floats, the whole kept ready to be stretched in front of the chain, at a distance of some 20 yards, and so to imprison the ice. The southerly winds, being always less violent, and being besides kept off by the shelter of the land, would never have sufficient force to break the dyke so formed, as we were able to ascertain from our experience with simple rope moorings. There is no fear of being boarded by really large icebergs, on account of the slight depth of water in our bay.

A road sufficiently wide to allow of the passage of the sledges was speedily made at the outset, affording an easy communication with the land. Under these conditions the winter was passed in complete security, apart from certain alarms on the occasion of storms from the north-east,

and in the most perfect comfort. Besides the plentiful stores taken with us, the seals, killed in some numbers at the beginning of winter and kept in the ice, never failed us, though it should be noted that we sometimes went several weeks without securing any. The meat is excellent, and the fat proved very useful for melting large quantities of ice. At Hovgaard island there are many more seals than at Wandel, but, except at Flanders bay, we never saw any but single individuals or small groups of from two to six. The cormorants, which were equally good eating, never left us; while the penguins, although they abandoned their rookery at the beginning of winter, frequently returned to the island in some numbers, except in August and September. During the whole winter the sheath-bills (Chionis) lived around the vessel like chickens or pigeons, eating the fragments thrown overboard. Lastly, we obtained a considerable number of good fish, either from the open water or from holes made in the ice, not to speak of the barnacles easily gathered from the rocks.

The scientific work was prosecuted without intermission throughout the winter, and to the satisfaction of all, thanks to the comfortable and convenient equipment of the vessel. We also took care to provide occupation and amusement for the men apart from their regular work. In the evenings we held classes for them, and I even gave them a course of instruction in English. Concerts, lectures, or readings of poetry also took place on Sunday evenings. Perfect harmony prevailed, and the best of spirits and good humour were maintained throughout the expedition. From April 27 to August 15, in order to make the most of the scanty daylight, the ship's chronometers were always set so as to mark five o'clock at the moment when twilight ceased, and as this harmless fraud was perpetrated from day to day, the crew were not even conscious of it.

The winter was relatively mild, the lowest temperature having been $-38°$ C. ($-30°{\cdot}4$ Fahr.); but the variations were excessively sudden, a rise from $-30°$ to $-3°$ C. ($-22°$ to $+26°{\cdot}6$ Fahr.) within a few hours being no uncommon occurrence, and always bringing in its train violent gales from the north-east, accompanied by snow and hoar-frost, and often lasting a long time. Winds from other quarters were never very violent, and were generally acompanied by fine weather. In summer the temperature was nearly always comparatively low, and if the north-easterly gales were of less duration, they were, on the other hand, much more frequent. During the winter, as far as we could see in Belgica strait, the water was constantly open, although often encumbered by floes and icebergs. The open sea to the west and south-west was frozen as far as we could see, but an expanse of several miles, at one time open, at another frozen, but always impassable either on foot or in boats, separated us from this pack-ice. To the south the ice appeared more stable, from Hovgaard island onwards, but ice of the

strait which separated us from this island was constantly, within a few hours, being broken up with the north-easterly gales.

It was not till May 12 that we were first able to venture on this ice, but it was again and again broken up after this, and though we had reached Hovgaard on May 30, we could not do so again until July 4. During July we continued our preparations for a forty days' trip which we meant to undertake on August 15, but on the second of that month the ice was once more broken up, and in spite of all our efforts we did not succeed in reaching Hovgaard in a whaleboat until September 6. We arranged a comfortable shelter under a rock, and deposited a month's provisions, but just then the pack to the south

LEMAIRE CHANNEL.

became impracticable. I returned to Hovgaard on October 24, on a thin floe, and this was entirely broken up by a gale only a few hours after my return.

On October 28 we undertook a several days' excursion in a whaleboat, and formed a depôt. We had very bad weather throughout the early part of November, but on the 10th M. Gourdon and the guide Dayné effected the difficult ascent of one of the peaks of the southern massif of Wandel island. Numerous other excursions were made, but the state of the ice and the bad weather proved great hindrances. On November 24 our usual party, consisting of two sailors, with MM. Pleneau, Gourdon, and myself, started in the whaleboat, which, with twenty days' provisions, weighed 9000 kilos. (20,000 lbs.). From the first

we had a struggle with the ice, and during almost the whole excursion we had to draw the boat along over ice which hardly bore its weight, and covered with a thick layer of melted snow, which forced us to walk with the water up to our knees. Often we had to break the ice for long distances in front of the boat, getting frequent baths as we did so. During the twelve days that this strenuous labour lasted we worked from ten to eighteen hours consecutively, economizing our food as much as possible. We reached an island south of Cape Tuxen, and, favoured by very clear weather, we were able to survey and photograph from six different points the whole coast from Wandel to the Biscoe islands. The strait which was thought by De Gerlache to possibly exist behind Cape Tuxen has really no existence. However, I can almost say for certain—as our hydrographical labours seem calculated to show—that the entrance to the Bismarck strait, reported by the German whaler Dallmann in 1873, exists in pretty much the spot where he placed it; only the general direction of the strait itself, which has been merely indicated by geographers at a venture, is not that given on our maps, especially that of Stieler.

Meanwhile work was actively prosecuted on board the ship, which remained fixed in a wide and thick field of pack-ice, but this began to loosen at the edges, and the ship commenced to open a channel. At the same time the guide, Pierre Dayné, ascended to the summit of the southern massif of Wandel. On December 10 the channel in the ice was begun by means of melinite, and by the use of saws, spades, and crowbars. On the morning of the 17th it reached the stern of the vessel, and as the ice was no longer supported, it began to float away under the impulsion of a strongish south wind, and the ship became completely free. A renewed trial of the boiler having given just enough pressure, there was nothing to delay the start for Wincke island, in order to change the record before continuing our explorations, when once we had secured a fine day for the completion of certain observations. We left behind at our winter station, a small house in sections, measuring 10 feet by 11 feet 6 inches, about 200 litres of alcohol, 375 boxes of condensed milk, 50 of sorrel, and a boat. We left also the magnetic observatory, with its pillar inside, as well as the pillar outside the stone house.* The tide *datum* was a horizontal line with the letter F above marked on a perpendicular rock at the point M of the plan which we left.

On December 25, the men made merry around a Christmas-tree brought with us from France. Our bay had for two days been somewhat blocked, but a change of wind during the night caused the ice to move away rapidly. At 8 a.m. the fires were lighted, and we hastened to get on board the cables, ice-anchors, etc. At 5.30 p.m. we set sail,

* The observations taken on these pillars are marked C. B. ("Cabane en bois") and P. E. ("Pilier extérieure") respectively.

and made the passage in fine weather with a breeze from the south-east, though occasionally obliged to force our way through the ice. We thus arrived without difficulty at the small bay where we had already anchored in February (Wincke island, Neumayer channel).

Here we were detained by a southerly wind, which caused the ice to accumulate at the entrance to our anchorage, and also brought with it bad weather. The guide Dayné and Jabet ascended a peak in the neighbourhood, while Gourdon and I ascertained that the cairn placed by us in Neumayer channel was in good condition. Gourdon also crossed a pass which gave him a view of Belgica strait, then free from ice. On January 3 a gale from the north-east began to free the entrances to our bay, and the following day, it being calm, although the barometer continued to fall, we started at 3 p.m. and changed the record left in the cairn on Neumayer channel as we passed. Becoming enveloped in fog, we entered Scholaert channel somewhat by guess-work, and getting a glimpse, when the fog lifted, of a wide and deep bay on the port side, we decided to seek shelter in it, as the weather was very threatening. The bay was surrounded by high ice-cliffs, and filled with floes and icebergs of all sizes. We found no anchorage or place where we could moor the ship, but, being well sheltered by the surrounding mountains, we remained under steam in the lee of a small island.

The next day, January 5, some strong gusts from the north-east compelled us to seek the excellent though dangerous shelter of the ice-cliff. We made an attempt to start at 3.30 p.m., but were driven back to our shelter until the next morning, when, in fair weather, we entered Scholaert channel and did some hydrographical work at several stations. Coasting the north side of Antwerp island, we steered west, avoiding the breakers through which we had passed unconsciously in February during a fog. There was a strong swell from the north-west, and icebergs were numerous, while in the evening we had to force a way through some 3 miles of heavy pack. On the 7th we put out our fires, and, with the help of a north-easterly breeze, steered south-east with all sails set. At 6 a.m. we saw clearly the summit of Mount William, and, skirting the ice within sight of the coast, came in sight of one of the most northerly of the Biscoe islands. On the 8th we had north-easterly squalls, with snow, and, scudding with three sails set, had a narrow escape as we passed between two huge icebergs. Two days later we took advantage of a fine interval to steer more to the south, but the weather and the ice soon became as bad as ever, and we held on to the south-west. The men had a hard time, the ropes and deck being covered with ice, the sea choppy, while snow and fog succeeded each other without a break.

On the evening of January 11 we reached the edge of very close pack-ice, which was studded with numerous icebergs, and extended as

far as we could see. We sounded, and found a depth of 250 fathoms. At 8 o'clock there appeared to the south-east a very high land—Alexander I. Land. During the night we remained at anchor, and the following morning continued along the edge of the pack-ice, which we had little hope of being able to enter. However, at 1 a.m. on January 13, in spite of the great swell, the large ice-floes, and icebergs, we cut into the pack. Our advance was very slow, and before long the ice became so compact that we were unable to move. To reach the land was absolutely impossible, and it was with great difficulty that we freed ourselves. In the evening we again saw Alexander I. Land, and a high summit much nearer was observed to the south-east. Shortly afterwards a long chain of mountains was visible still further to the east. I decided to continue along the pack to the eastward in the endeavour to find a weak place which might allow us to reach the land.

At 8 o'clock on January 14, we perceived a rocky triangular summit a comparatively short distance away, in the direction in which we were steering. Early the following morning we attempted to force our way into the very compact and extended ice which separated us from the land, which now seemed to stretch away to the eastward in the form of a promontory. This is a high chain of mountains on a base of ice and snow, a continuation of that which we had seen in the previous evening. With great difficulty we managed to force our way into the ice, and scarcely a mile from the land we found a narrow channel of open water. The coast appeared to form a cliff of jagged ice, and presented no point at which it was possible to land. We steered towards the promontory to the east, with the intention of approaching the land from the south-west, if the channel did not close up.

We proceeded some 10 miles, and were about a mile from land when, in passing a large tabular iceberg of more than 150 feet high, the ship received a terrible shock, striking four or five times with great violence and freeing herself before the engines, which had been reversed, could produce any effect. The bows were taking water, and the pumps were immediately got to work. Our situation was a bad one, as no landing could be made on this coast, and other submerged rocks might be encountered; besides, there was the possibility of the ice closing up, and if it was necessary to continue pumping, it would be impossible to risk wintering on board, so it became urgent that we released ourselves from the ice quickly. We could not count on our engines, as they had been damaged, but, favoured by a north-east wind, and profiting by the small channels, we proceeded with infinite caution to retraverse the pack-ice. Several hours of clear weather fortunately permitted us to accurately fix our position, and survey and draw carefully this new but inhospitable coast. While thus engaged the pumps were kept working, each taking his turn willingly, following the good example set by MM. Pléneau and Gourdon, who worked with the men.

In spite of our damage, we decided to try and regain one of our known anchorages, and continue as much as possible the hydrography of the coast. The state of the ice and our damaged condition would not allow us to proceed further south, at least for the moment, so it remained for us to continue the work in the region where we were, and even a little to the north.

On January 19 we steered towards the land, which we were soon able to distinguish, and at 10 a.m. entered a large bay enclosed by large islands, separated from us by thick pack-ice, which we endeavoured to pierce, but its thickness increased, and the icebergs came so close that we gave up the attempt. No opening could be seen anywhere,

CORMORANTS.

and neither the coast nor islands appeared to offer a landing-place. The weather became stormy, and the wind blew strongly from the north-east; but although we were surrounded with icebergs, we were comparatively sheltered by the pack and the islands, which were evidently Biscoe islands, and we decided to remain here during the gale. In the morning the weather cleared, and we left our anchorage and steered towards the north, following the edge of the pack, only to encounter heavy seas and thick fog, which lasted three days.

On January 24, during a short clearance we saw to starboard some breakers, then a reef, and further away a cap-shaped island surrounded by reefs, probably the most northerly of the Biscoe group. On January 26 we saw Mount William to the south-east, about 75 miles distant.

We continued along the land in the direction of Scholaert channel, of which we wished to complete the hydrography. Whilst the weather permitted, we continued the survey we had already begun of this channel, and fixed the position of the group of islands.

On January 29 we entered Belgica strait, but a strong wind from the south-west retarded our progress, already none too rapid, but shortly after midday we anchored in a small harbour, which we had provisionally named Port Penguin.

The men were weakened by the excessive fatigues of the hard voyage we had made, and the results of the winter had made itself felt upon their health. Nearly all were enfeebled and ate little; but none complained, and kept in good spirits. From February 8 to 11 the weather was magnificent, but up till then it had not ceased to be bad. The men were able to rest and nurse themselves, these last days of sunshine especially benefiting everybody.

The repairs to the engines were finished, and, profiting by the transparency of the water, we were able to estimate the damage to the bows of the ship, which was serious enough, perhaps more serious than we had thought.

While in this excellent harbour everything was put in order on board the ship, and the water-tanks filled. Every day we fished and caught a score of large and excellent fish. The guide Dayné and the storekeeper Jabet accomplished in twenty-two hours a very laborious and dangerous ascent of the highest summit of Wincke, about 5000 feet. I decided to give to this peak the name of Louis de Savoie, the first man to climb it being an Italian.

On February 11 we tried our engines, which worked almost satisfactorily, and enabled us to weigh anchor and proceed to Biscoe bay. Favoured by magnificent weather, we reached the end of the bay before a rocky peninsula, which is almost certain to be the place where Biscoe landed. We took several photographs in the historic bay, which Biscoe would certainly have done had he had a camera. In the evening we regained our anchorage.

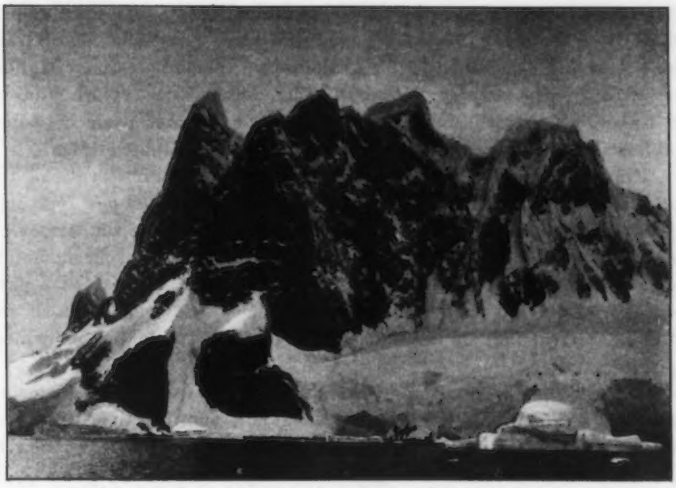
We afterwards returned through Belgica strait, where we again had to struggle against fog and bad weather from the north-east, and after remaining to make a survey of the narrow channel which separates Liege island from Brabant island, we followed the coast of Hoseason island, discovered by Foster in 1829. We landed near Cape Possession, where various work was executed, and after a rapid survey of the neighbouring islands, which agrees with that of the commander of the *Uruguay*, Captain Galindez, we said *Au revoir* to the Antarctic, leaving the last iceberg at Low island.

We anchored on March 4 at Puerto Madryn, where we learned with surprise of the anxiety which prevailed on our account, and I take advantage of this occasion to thank all those who have sought to

reassure us, and in particular Mr. Bernacchi, from whom I have contracted a large debt of gratitude.

It was my intention to tell you, at the beginning of this meeting, that it is impossible to give you for some time the scientific results of our expedition; however, I shall be pleased to send the Society a list of the work done, together with some of the results which are already known.

Hydrography.—A regular triangulation, departing from a measured base, has been effected from our winter quarters, the island Booth-Wandal, in a radius from 2 to 5 miles. From the extreme stations of this set of triangles we were able to take bearings of different peaks



CAPE RENARD.

from 30 to 40 miles distant, which will permit the placing of these points with considerable accuracy. On these positions rest the compass surveys executed afterwards, either in the changes of the ship's position, or on the spring journey to the south. A region of 30 to 50 miles around Wandel island was thus determined by triangulation.

The other positions of the coasts surveyed were determined by means of positions at sea resting on astronomical observations. These are—to the north, the exterior contour of the Palmer archipelago and Scholaert channel; to the south, Biscoe islands and two still unknown portions of Graham Land, of about 30 miles each. It is interesting, in regard to the islands bearing his name, to remark that Biscoe only fixed Pitt and Adelaide islands, and was content to indicate between these two islands a chain of smaller islands covered with an ice-cap. Pitt

island is given in three different positions in English and German publications and in the Admiralty charts. These positions differ between them, either 1° in latitude or longitude. The result is a great uncertainty about the position of Biscoe islands, which Gerlache passed without seeing in that which is assigned to them on the British Admiralty charts. We have not obviously been able to survey these islands completely, the straits which separate them being completely blocked with ice, but we have been able to fix their exterior contour, giving their breadth, which is the most important point for navigation. They lie close to Graham Land. The survey of the exterior coasts of the Palmer archipelago completes entirely the geography of that region, in conjunction in the north, centre, and south with the map of Gerlache strait drawn by the *Belgica* expedition. We were able to identify to the north Hoseason island and Cape Possession, determined by Foster and Kendall in 1829; to the south, Bismarck estuary, sighted in 1873 by the whaler Dallmann, and undoubtedly before him by J. Biscoe, who landed there in 1832, in the bay which bears his name, probably on the same rocks where we had a hydrographic station.

Finally, we were able to set, on good astronomical observations, the bearings of Alexander I. Land, to which the ice prevented our approach.

The rate of the chronometers was determined during the winter by means of the sextant observations of M. Claude. Our chronometers were kept in an almost constant temperature, and maintained a very regular rate. One may hope in deducing, by the comparison of the time of arrival and of departure, an exact longitude for our winter quarters.

Tides.—The *régime* of tides was studied by means of a registering tide-gauge, which was working for about six months. The tides are feeble (about 5 feet being the maximum), but very regular, contrary to the nautical instruction in vogue. The cause of this irregularity is, that they have a *régime* of diurnal preponderance, while the tides in the neighbourhood of Cape Horn and South Georgia are semi-diurnal. Treated by the method of harmonic analysis of Prof. Darwin, the observations of the fifteen first days served to predict with considerable exactness the tide of a day determined five months later. The observations collected will allow us to calculate, by the above method, the principal waves composing the tides at the point studied. We took also some tidal observations at two other points—Wincke island and Flanders bay.

Colour and Density of Sea-water and Sea-ice.—During our winter, samples of sea-water and sea-ice, at different periods of formation, were collected and tested during the voyage. The density was measured by means of a Buchanan areometer; the proportion of chlorine by the Mohr-Bouquet de la Grye method.

Gravity Observations.—We possessed one of M. Bouquet de la Grye's

comparison pendulums, by means of which seven series of measurements were made in Wandel island. Similar measurements were made in Paris by means of the same instrument placed under the same conditions. The comparison of duration of oscillation, with all corrections made, should give the force of gravity at Wandel island to correspond with the figures observed at Paris.

Of the meteorological studies, which were carefully conducted, the chief results are—low summer temperatures, great and sudden thermometric changes, frequent north-east and east-north-east squalls, with thermometer high and barometer low; fair weather with gentle south-south-west breezes, with low thermometer and high barometer (mean about 30 inches). Lastly, in fine weather, very great regularity in the diurnal variation of the hygrometric conditions, a variation identical with that observed at Cape Horn.

Polar auroras very rare and faint.

It is interesting to compare the simultaneous character of our meteorological records with those of Año Nuevo, and of the observatory established at the South Orkneys.

Terrestrial Magnetism.—This study consisted of absolute observations of D., I., and H., and in hourly observations of D. and H. The monthly diurnal variation of these two elements was determined by at least two series of twenty-four hours. A few disturbances were also studied.

The curves obtained are merely an amplification of those of Cape Horn. They will enable the isolated observations previously made in the Antarctic to be approximately systematized.

In atmospheric electricity the two main results are—about 70 volts per metre for the difference of potential between two points of the atmosphere, and very strong electric tensions during most of the north-east squalls. Besides the measurements of tension, we studied the loss, in the atmosphere, of the electricity with which objects were charged. The apparatus employed were those of Elster and Geitel. We carried out the same studies as those made by the Danish Mission to Cape Thordsen.

Zoology and Botany.—In these branches our observations and researches have been most fruitful. Both the zoological and botanical specimens collected come from the various stations visited—Flanders bay; Wincke island; Wandel island (winter station); Biscoe bay (Antwerp island), and another bay in that island; lastly, Hoseason island. Fishing with line, trawl, bag, and net yielded numerous specimens of the inshore fauna and flora, and this class of collections was completed by many excursions along the coast.

The cetaceans, several species of which were met, formed the subject of a few observations.

The seals, very numerous in these regions, and represented by four known species, gave occasion to some interesting notes. Of these, a

number of specimens have been brought back in the form of skins, skeletons, and skulls.

In our collections, birds are represented by one hundred specimens, consisting of skins, fledgelings, embryos, eggs, etc. Other members of the animal kingdom were captured by means of the above-mentioned fishing-gear.

The fishes, taken in considerable numbers down to depths of 200 feet, represent some fifteen species. On the collection of invertebrates, Prof. Joubey states, "As far as one can judge after a few hours' inspection, and after a rapid arrangement of the materials in large sections, a rough estimate may already be formed of the interest presented by the very numerous objects brought back by Dr. Charcot.

"An attractive feature of this collection is the fact that it comes mainly from shallow inshore regions in the Antarctic. From this point of view, it fortunately completes the work of previous expeditions, such as that of the *Belgica*, nearly all the captures of which were fished up from depths of from 200 to 300 fathoms. Thus, so far as regards the marine invertebrates, these two expeditions, far from going over the same ground, complement each other in a very happy and useful way. I should not like to make even a superficial estimate of the objects received in my department. Still, I may point out a very fine series of echinoderms, including some sea-urchins, star-fish, and crinoides, all not only new, but most interesting from the morphological standpoint. There is also a fine series of annelides, of worms, of nemertes and planaria, besides a considerable quantity of all kinds of parasites—intestinal worms from seals, birds, and fishes. These materials promise to yield highly interesting discoveries.

"The molluscs are remarkable for some magnificent nudibranches, and new or extremely rare shell-fish. The sea-anemones, the octopuses, squids, and medusæ form a remarkable group, if not in number, at least for their novelty.

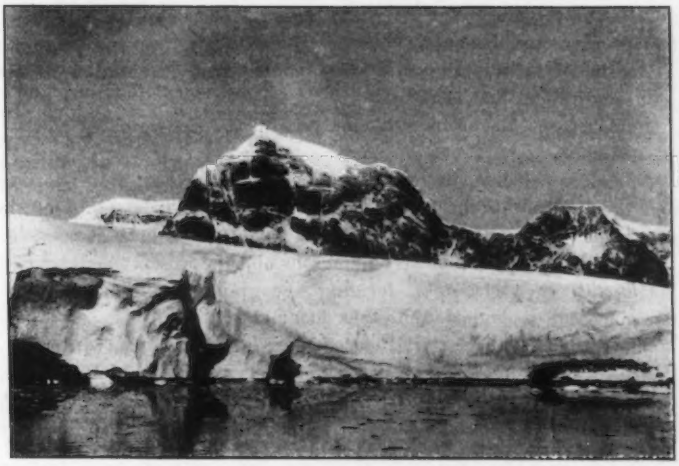
"A vast number of ascidians, including some most curious forms, have been obtained from the surface down to a depth of 60 fathoms. These ascidians are likely to yield important discoveries.

"I find it impossible to say anything about the brachiopods, the cephalopods, the innumerable polyzoa, and a superb collection of sponges. Of all this we can for the present form no more than a general impression—an impression that the Antarctic littoral fauna is being unveiled.

"In the class of insects are comprised specimens of Diptera and Hemiptera. The crustaceans are represented by numerous individuals belonging to the groups of copepods, amphipods, schizopods, and isopods. Several species of acarides have been found in the mosses, while others are parasites of the birds. From the pantopods were also produced some good specimens."

In botany a great mass of materials was gathered amongst the algæ, representing the groups of florideæ, theophyceæ, chlarophyceæ, and oscillariaceæ, besides numerous species of diatoms. Special attention was given to those of the pack and fringing ice. During our land and climbing trips we secured specimens of mosses, lichens, and freshwater algæ. Lastly, two species of phanerograms were discovered in the Antarctic islands. The first was a grass, the *Deschampsia* (*Aira*) *antarctica*, found in Wandel island (65° 5′ S.) and in Biscoe bay; the second a caryophyllacea, the *Colobanthus crassifolius*, var. *B. brevifolius*, Engler, found only in Biscoe bay (Antwerp island, 64° 50′ S.).

Geology.—Notes and observations on the geological constitution of



DUKE OF ABRUZZI PEAK, WINCKE ISLAND.

the explored regions. Physical geography of the lands traversed. Specimens of the rocks, of the glacial muds, of the sands and gravels of the seaboard. Photographs of the surface relief. Glacial action, erosion, weathering.

The region traversed consists essentially of crystalline rocks, and especially of granites. There are no sedimentary formations, nor any fossils. Hence the chief interest is petrographic, and we have brought back somewhat numerous specimens of the rocks. Iron pyrites abounds in these rocks, and the relief of the mountains is continually modified by their sub-aërial oxidation and transformation into limonite, and by the disintegration of the rocks which have already been greatly weathered by the action of frost. The relief takes the general form of steep ridges sharply outlined with a main north-east to south-west trend, broken by fissures at right angles with their direction, and forming

fjords on very low hills. The microscopic examination and chemical analysis upset the relation that might be established between these ranges and the Cordillera which bends round from Chile into Tierra del Fuego, and is apparently continued by the South Orkney islands.

Notes on the movement of ice, especially in the bays near the winter station; formation of the marine ice in those bays.

Notes on the movements, dimensions, and transformations of the icebergs; table icebergs.

Thickness of the fringing ice; its formation and destruction.

Constitution of the glacial headlands in the islets of the archipelagos west of Graham Land.

General direction of these islets.

Notes on the glaciers of Danco Land and of the Palmer archipelago; their progress and discharge.

Ascent of a summit in Wandel island, and exploration of the mountain crest in that island.

Bacteriology.—Bacteriological analysis of the sea-water, of the air, ice, and snow.

Numerous cultures (in good condition till the present time) derived from the analysis of the sea-water and of the intestinal fauna of the seals, birds (penguins, gulls, cormorants, petrels), and fishes.

Rubbings and preparations; numerous objects preserved.

Collection of photographs, forming geographical, hydrographical, meteorological, zoological, and other documents.

Photographs of the installations of apparatus during the winter.

Medical Observations.—A serious case of myocarditis which occurred at the winter station. On some circulation troubles which may possibly be attributed to Bright's disease. General survey of the sanitary condition of the expedition.

Before the paper, the PRESIDENT said: I now have the honour to introduce to you Dr. Jean Charcot, who has been good enough to come over from Paris to read to us a paper on his Antarctic work, from which he has only just returned. The general outlines of his voyage are well known to all of you who study attentively the *Journal* of the Society. But I expect that you do not know the full extent—in fact, you cannot know the full extent and value of his work until you hear Dr. Charcot's account that he is going to give us to-night. I have no doubt that many of you must have felt with us keen anxiety at the beginning of this year about the safety of the expedition. You will remember the reports that were brought back to South America and telegraphed home by an Argentine gunboat as to the probable loss of all concerned; and I remember vividly a day in last March—I was living in France at that time—when I took up the *Matin*, which, as you remember, was the newspaper which contributed so largely to the expense of the expedition, and found in it a telegram announcing the safe return of Dr. Charcot and all on board. I need not tell this audience that the name of Charcot has been long a household word in this country, where the reputation of the late

Dr. Charcot is, I think, as firmly established and as widely known as it is in his native land. There is no need for me here to expatiate on the extraordinary merits of that great man, whom we all lament. But Dr. Jean Charcot, his son, was not content to live only in the reflected light of a great name; he is himself an eminent bacteriologist, besides being a recognized authority in other sciences more or less connected with his own profession, which is that of medicine. Fortunately for geography, Dr. Jean Charcot is also an enthusiastic yachtsman, to which amusement he has devoted a good deal of his time, and it was as a yachtsman that he went three years ago to the island of Jan Mayen, within the Arctic circle, which, as we know, very few expeditions have gone to, and which may perhaps have given him a taste for Antarctic exploration. It is now three years since—no, two and a half years—since Dr. Charcot determined to promote the advancement of knowledge by organizing and personally conducting this French Antarctic Expedition. He himself contributed, I may tell you, the greater portion of the expense of that expedition. This threefold combination of scientific competence, of pecuniary generosity, and of personal service is sufficiently rare to merit our admiration, and I think that it furnishes one more proof, if proof were needed, of the general truth of that old French proverb, "Bon sang ne peut mentir." We welcome Dr. Jean Charcot here as an explorer and geographer all the more cordially on this occasion because our minds are still full of interest in another Antarctic Expedition of which this Society was the principal promoter and organizer, and yet I think that we welcome him, perhaps, now even more warmly as the distinguished representative of the scientific spirit and of the courageous enterprise of our great and friendly neighbour, France. It is a pleasant thought that the only rivalries that now exist or that are at all likely to exist in the future between the two countries are peaceful rivalries, and long may those peaceful rivalries continue for the benefit of the two countries and of the world at large. The thought is all the more pleasant because we have lived through a period of about twenty years, during which the sudden opening up of a vast continent—the great continent of Africa—inevitably produced rivalries of a very different kind, and I may confess, personally, that during those twenty years the words "a French Expedition" did not arouse in me that warm desire for its success which we have all felt in watching the progress of the voyage of Dr. Jean Charcot to the Antarctic Regions. Well, I do not think that as good geographers we ought to regret the rivalries or even the jealousies of those twenty years, because those were the incentives that produced innumerable expeditions from which we have derived an immense amount of geographical knowledge, and that geographical knowledge remains for the benefit of mankind now that the political rivalries of those bygone days, those forgotten days, have vanished like last year's snows before the warmth of the *entente cordiale*. I now call upon Dr. Jean Charcot to deliver his address.

After the paper, Captain R. F. Scott said: I do not know that I can say many words, except to thank the lecturer for his delightful paper. All of you, I am sure, have been intently interested in it, but none can have been so interested as I and those of my companions who were in the *Discovery* with me who are here to-night. There is a great bond in the ice. Dr. Charcot and I talked over it at dinner, and we agreed that if a French expedition goes one way and an English another way, and if we meet, that then there will be a cordiality that has never been realized yet, even in the *entente cordiale*. To show the importance and the interest of it to me, I may say that throughout the lecture there has not been a picture or a remark that Dr. Charcot has made to which I have not wished to say, "Stop and explain," and I assure you

it is quite like old times to have seen those icebergs on the screen again. I think I may say we all thank Dr. Charcot most cordially for his paper.

Mr. BERNACCHI: It has been most interesting to listen to the lecture delivered by Dr. Charcot this evening, and I may say that I am especially interested in the French Expedition, because it was my very great pleasure some months ago to be invited to Paris to give an address on our recent experiences with the *Discovery*. I endeavoured, at that time, when there were some fears prevailing in France with regard to the fate of the French Expedition, to point out that at that early period there was no necessity for any grave fears with regard to its fate. Fortunately, those sanguine views were fully realized. But at the same time I took the opportunity, the modest opportunity, of speaking at some length of our experience and discoveries in the Antarctic, and the remarks that I made were received with appreciation and applause, notwithstanding the fact that I spoke French with an accent that it would be kindness to describe as somewhat faulty. Geographically, there is a point that rather strikes one on looking at the admirable photographs that we have seen to-night, and that is the strong resemblance between the Antarctic land in the direction south of Cape Horn and the land of South Victoria Land; that is to say, those lands are as heavily glaciated as the lands that we discovered in latitudes between 70° and 80° S., indicating, on account of the considerable difference in latitude, a possible severer climate on that side of the Antarctic than the one prevailing south of Australia. But even more interesting than the geographical results are probably the scientific results. Unfortunately, it is impossible to produce the full result of those scientific observations, but there are many new facts that I feel sure are of extreme interest; the remarks that Dr. Charcot has made with regard to the tides, for instance. I think that considerable light will be thrown, when those observations are combined with the observations taken on the *Discovery*, on the tidal phenomena existing near the south pole; and also the gravity observations, when combined with our gravity observations and those taken on the German Expedition, ought to throw considerable light on the gravity conditions prevailing in the southern hemisphere. But what has struck me most to-night, and, I think, must have struck every one here, is that Dr. Charcot and every member of the French Expedition has been actuated by that grand motto of Prince Henry "the Navigator," "*Le talent de bien faire*," that is, the desire, the wish, the keen enthusiasm to do well, which spells success.

Dr. WILSON: I think the best thing that I can do is to say as little as possible, except to add my quota of thanks to the extremely interesting paper which Dr. Charcot has put before us. Each of us had his own work in the *Discovery*'s expedition, and as mine lay amongst the birds and the seals, I should like just to take this opportunity of saying that the photographs which we have seen this evening were most interesting as representing the birds of that part of the Antarctic. They were birds, in some cases, which we never saw at all. The birds of the Antarctic vary from one part to another, and such things as sheath-bills, of which we saw beautiful photographs just now, and of the cormorants, we saw nothing. It is, therefore, exceptionally interesting when we get papers of this sort dealing with different parts of the Antarctic which show different aspects of the same question. I think that the less I say the better now at this late hour, and I can only add my thanks to my appreciation of the work which Dr. Charcot has done.

Dr. MILL: I desire to reflect the wisdom of Dr. Wilson and say very little, but as a student of the history of Antarctic exploration, I must express the gratification it gives one to see the French flag once more in the southern ice. The French were leaders in Antarctic work at an early date, though many of their most interesting voyages have been almost forgotten. The cruises of Bouvet, Kerguelen, and above all of Dumont D'Urville, are full of interesting features, and their gallant

attempts, both south of Cape Horn and on the other side south of Australia, are things that could not be forgotten. It is delightful to see how the scientific enthusiasm of Dr. Charcot has enabled him, with extremely slender resources, to get very fine results indeed. I look forward particularly to seeing the determinations of longitude, especially with regard to that extremely interesting group the Biscoe islands, which have been drifting about on the chart in a way which might almost suggest that the moving ice was carrying them from their moorings. I hope, when Dr. Charcot's chart comes out, we shall have the whole of the Palmer archipelago clearly defined, and that will be a great service indeed.

The PRESIDENT: I do not know if any one else wishes to address the meeting; if not, I would propose a vote of thanks to Dr. Charcot and one of his companions whom I understand is present to-night. I need say nothing about the great pleasure that Dr. Charcot has given us. The way in which his paper has been received speaks for itself.

Dr. CHARCOT: I thank you exceedingly for the very kind reception, and the kind words that have been said to me, and I will, when I am back in Paris, tell all those who came with me, staff and crew, of the way in which we were received, and they will be exceedingly gratified. There is one thing certain, namely, that the applause goes more to them than to myself. Certainly I should not have done what I have if I had not been seconded in such an excellent way. And as Captain Scott said, if we could get two expeditions—an English expedition coming from King Edward's Land, and a French expedition coming from President Loubet's island, I can promise Captain Scott the French crew would do its best, and I think it would do good work.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART IX.—THE LOCHS OF THE SHIN BASIN.

IN this paper it is proposed to deal with the lochs visited by the Lake Survey draining by the river Shin and river Oykell into the Dornoch firth, viz. Lochs Shin, Merkland, a' Ghriama, Fiodhaig, Gorm Loch Mòr, Ailsh, Craggie, an Daimh, Migdale, and an Lagain, and it has been found convenient to include also Loch Buidhe, flowing by the river Fleet into Loch Fleet, lying to the north of the Dornoch firth. The drainage area to be dealt with is indicated on the small index map shown on p. 521, and extends from Tarbat Ness on the east to Cnoc a' Choilich (little more than 3 miles from the shores of Loch Broom) on the west, and to Ben Hee and Carn Dearg on the north, the total area being about 860 square miles, of which about 770 square miles drain into the Dornoch firth, and about 90 square miles into Loch Fleet. Of this total about 240 square miles drain into the lochs under consideration, as will be seen from the summary table at the end of this paper. The

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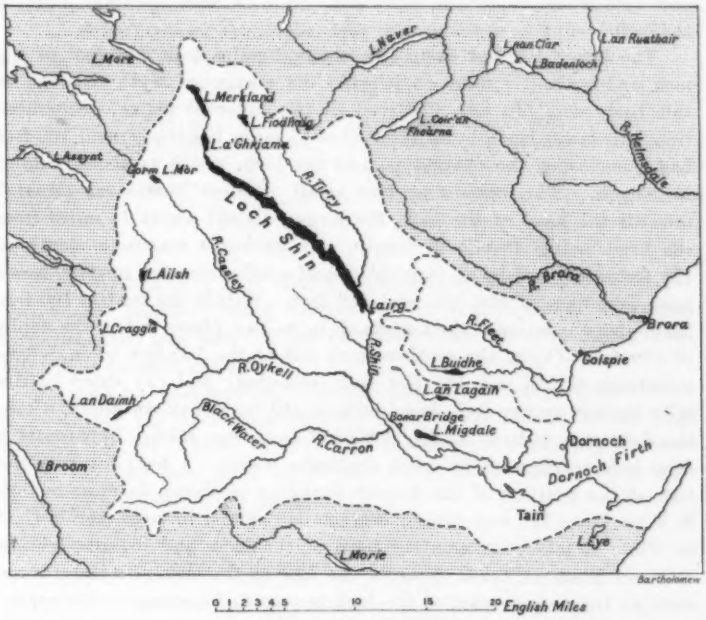
* Plates, p. 592.

principal loch is Loch Shin, one of the largest of Scottish lochs, the others being comparatively small, Loch Merkland being the only one exceeding 2 miles in length. Loch Shin receives the outflow from Lochs Merkland and a' Ghriama at its northern end, and the outflow from Loch Fiodhaig about 5 miles down on its eastern shore. Gorm Loch Mòr lies at the headwaters of the river Cassley, a tributary of the river Oykell, and Loch an Daimh flows by the river Einig into the river Oykell, which also receives the outflow from Lochs Ailsh and Craggie. The river Shin, bearing the outflow from Loch Shin, joins the river Oykell to form the Kyle of Sutherland at the head of the Dornoch firth. Loch Migdale flows by a short stream into the Dornoch firth on its northern side, and Loch an Lagain flows by a longer stream (the river Evelix) also into the Dornoch firth on its northern side. Loch Buidhe flows by the river Torboll into the river Fleet at the head of Loch Fleet. The boundary-line between Ross-shire and Sutherlandshire follows the course of the river Oykell from the head of the Dornoch firth to Breabag Tarsuinn, passing up the middle of Loch Ailsh, which thus lies partly in Ross and partly in Sutherland, while Lochs Craggie and an Daimh are located in Ross-shire and the remaining lochs under consideration in Sutherlandshire.

Loch Shin (see Plates I. and II.).—Loch Shin is the largest loch in Scotland to the north of Loch Ness, and as regards length it ranks fifth of all Scottish lochs, being exceeded in this respect only by Lochs Awe, Ness, Lomond, and Shiel. It is a fine sheet of water situated amid beautiful scenery, with Ben More Assynt and Coniveall rising to heights exceeding 3200 feet on the west, and Meall an Eoin (3154 feet) on the north-east. It is a good trout loch, containing also *Salmo ferox*, and the islands are much frequented by wildfowl. It trends in a north-west and south-east direction, and the length measured along the centre of the loch is about $17\frac{1}{4}$ miles. The loch is on the whole very narrow, the maximum breadth exceeding 1 mile at the junction with the small arm leading to Loch a' Bhainbh, and also at the position of the delta formation at the mouth of the river Fiodhaig. Elsewhere the breadth is considerably less than a mile, and the upper portion, to the north-west of the entrance of the river Fiodhaig, is all less than half a mile in width. The mean breadth of the entire loch is half a mile, or only 3 per cent. of the length—a percentage smaller than has been observed in any other loch except Loch Shiel.* The waters of Loch Shin cover an area of about 5570 acres, or nearly $8\frac{3}{4}$ square miles, and the area of land draining into it is over 150 square miles, but as it receives the outflow from Lochs Merkland, a' Ghriama, and Fiodhaig, its total drainage area is over 190 square miles—an area twenty-two times greater than that of the loch. Over 800 soundings were taken, the maximum depth

* See *Geographical Journal*, vol. 25, p. 270, March, 1905.

recorded being 162 feet, about 7 miles from the foot of the loch, opposite the little Loch an Fhreiceadain on the north-eastern shore. The volume of water contained in the loch is estimated at 12,380 millions of cubic feet, and the mean depth at 51 feet, or 31½ per cent. of the maximum depth. Loch Shin was surveyed on August 25 to September 1, 1902, when the elevation of the lake-surface above the sea was determined by levelling from bench-mark as being 270·85 feet; when levelled by the officers of the Ordnance Survey on August 4, 1870, the elevation was found to be 269·7 feet above sea-level. The farmer at



INDEX MAP OF THE SHIN BASIN.

Overscaig stated that the water might fall 1 foot below, and rise 6 feet above, the level at the time of the survey.

The floor of Loch Shin is very irregular. None of the contour-lines are continuous from end to end of the loch, and the lines themselves are usually of a sinuous character. The 25-feet contour encloses two areas, the 50-feet contour three areas, the 100-feet contour four areas, and the 150-feet contour two areas. The lower 25-feet basin is nearly 10 miles in length, extending from close to the lower end of the loch as far as the alluvial cone at the mouth of the river Fiodhaig. Here for an interval of nearly half a mile the soundings indicate depths less

than 20 feet, except for an isolated sounding of 25 feet towards the north-eastern shore. The upper 25-feet basin is nearly 6 miles in length, approaching to within half a mile from the head of the loch. The lower 50-feet basin is about 8 miles in length, extending from within a quarter of a mile from the southern end as far as the entrance of the Allt a' Chairr Bhig. Separated from this lower basin by an interval of more than half a mile there is a second small 50-feet basin based upon soundings of 60, 70, and 80 feet. Proceeding up the loch from this small basin, there is an interval of nearly 3 miles before meeting with the upper 50-feet basin, which is 3½ miles in length, and approaches to within three-quarters of a mile from the head of the loch.

The lower 100-feet basin lies about 2 miles from the foot of the loch, and is about 2 miles in length; the maximum depth recorded in this basin was 140 feet, observed in two different places. Separated from this lower basin by an interval of 1½ miles lies the central 100-feet basin, enclosing the deepest part of the loch, which is about 2 miles in length. The remaining two small 100-feet basins are situated towards the head of the loch, the larger, distant about 1½ miles from the head, being 1 mile in length, and having a maximum depth of 129 feet, separated by an interval of half a mile from the smaller, based upon soundings of 104, 106, and 108 feet. Within the central 100-feet basin above mentioned the bottom sinks in two places below the depth of 150 feet—(1) at the south-eastern end of the 100-feet basin, where soundings of 156 and 157 feet were recorded; and (2) about half a mile farther up the loch and towards the north-eastern shore, where the deepest sounding in the loch (162 feet) was taken—apparently a deep hole surrounded by much shallower water. A section across the loch at the position of the deepest sounding is shown in cross-section E–F on Plate II., and similar sections are shown in cross-section C–D on Plate I. taken towards the head of the loch, and in cross-section G–H on Plate II. taken towards the foot of the loch. In these three sections the deepest part of the loch is seen to lie nearer to the north-eastern than to the south-western shore, but this disposition does not hold good throughout the loch, for in some of the other lines of soundings the deepest casts were taken towards the south-western shore. The longitudinal section A–B, placed at the foot of the two maps, taken along the axis of maximum depth from end to end of the loch, shows how irregular the lake-floor is along this central line, and many of the lines of soundings indicate undulations more or less pronounced, some of which give rise to striking sinuosities in the contour-lines, while others do not affect the contours, or only slightly, and are therefore not so easily remarked. As a rule, shallow water is found offshore, but occasionally deep soundings were taken close inshore—for instance, off the small promontory on the north-eastern

shore, $1\frac{1}{4}$ miles from the head of the loch, a sounding of 36 feet was recorded; farther down the same shore, off the mouth of the an Garbh-allt, a sounding of 57 feet was taken; near the pier at Shiness quarry on the same shore depths of 32 and 40 feet were found; and along the opposite shore towards the foot of the loch depths of 32, 36, 37, and 38 feet were found here and there inshore.

The alluvial cone at the mouth of the river Fiodhaig has already been referred to, and here shallow water extends right across the loch, cutting it into two deeper portions. The land has been cut into a delta-shaped form at the head of the loch, where the river from Loch a' Ghriama flows into Loch Shin.

The areas between the consecutive contour-lines at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	3260 ...	58·5
50 „ 100	1480 ...	26·6
100 „ 150	814 ...	14·6
Over 150	14 ...	0·3
	5568	100·0

These figures show that Loch Shin is comparatively shallow, 58 per cent. of the lake-floor being covered by less than 50 feet of water, and 85 per cent. by less than 100 feet of water, while the area deeper than 150 feet is exceedingly small.

Temperature Observations.—Numerous surface temperatures were taken during the week spent on the survey of Loch Shin, the readings ranging from 56°·0 Fahr. to 59°·0 (the air-temperature during the same period ranging from 52°·6 to 63°·0). Three serial temperatures were taken, with the following results:—

Depth in feet.	August 27, 1902, 5.15 p.m	August 30, 1902, 6 p.m.	September 1, 1902, 5.30 p.m.
	° Fahr.	° Fahr.	° Fahr.
0	56·5	56·7	57·0
25	—	56·1	56·8
50	56·0	56·0	56·6
90	—	56·0	—
100	54·2	—	—
150	51·2	—	—

These observations show that the whole body of water down to a depth of 90 feet was practically uniform in temperature, but in the deepest part of the loch a fall of temperature amounting to 3° was observed between 100 and 150 feet. The extreme range of temperature from surface to bottom and from end to end of the loch amounted to only 7°·8.

Loch Merkland (see Plate III.).—Loch Merkland lies about 3 miles to the north of the head of Loch Shin, amid beautiful surroundings, Ben Hee rising to a height of 2864 feet on the north-east, with Carn Dearg (2613 feet) and other heights to the north, and Ben Leoid (2579 feet) to the west. It trends in a north-north-west and south-south-east direction, and is 3 miles in length, with a maximum breadth of over one-third of a mile, the mean breadth being a quarter of a mile. Its waters cover an area of about 440 acres, or two-thirds of a square mile, and it drains an area of about 16 square miles. Nearly one hundred and twenty soundings were taken, the maximum depth of 85 feet having been observed close to the narrows towards the head of the loch. The volume of water is estimated at 577 million cubic feet, and the mean depth at over 30 feet. The loch was surveyed on September 2, 1902, when the elevation of the lake-surface above the sea was found to be 360·2 feet.

Loch Merkland is comparatively simple in conformation; the deeper water occurs towards the head of the loch, and is cut into two portions by a shoaling of the bottom at the narrow portion where the large alluvial cone laid down at the mouth of the Allt nan Allbannach on the north-eastern shore approaches the smaller cone at the mouth of the Garbh Allt on the opposite shore. The depth of the channel at the narrows referred to is 31 feet, and the 10-feet and 25-feet basins extend from end to end, roughly approximating with the outline of the loch. The principal 50-feet basin extends from the narrows for a distance of three-quarters of a mile down the loch, and there is an isolated sounding of 52 feet to the north-west of the narrows. The 75-feet basin is a long and narrow area, half a mile in length, the deepest sounding having been recorded at the upper end of this basin, and comparatively close to the south-western shore, off which the slope is steep. This is well shown in the cross-section E–F on the map, and at other places along both shores the soundings indicate steep slopes. The longitudinal section A–B shows the shoaling of the water at the narrows, deepening immediately to the south-east to the maximum depth of the loch; there is also a scarcely perceptible shoaling farther down the loch, where a sounding of 37 feet was recorded, with 47 feet to the north-west, and 41 feet to the south-east. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	190 ...	43
25 „ 50	198 ...	45
50 „ 75	37 ...	9
Over 75	14 ...	3
	439	100

These figures show that the average slope is slightly steeper within

the 25-feet line than between 25 and 50 feet, and they also show how circumscribed is the area deeper than 50 feet, 88 per cent. of the lake-floor being covered with less than 50 feet of water.

Temperature Observations.—A series of temperatures taken in the deepest part of the loch at 6 p.m. on the date of the survey gave the following results :—

Surface	56°·8	Fahr.
25 feet	56°·2	„
50 „	56°·0	„
80 „	55°·8	„

These observations indicate a range of only 1° from surface to bottom.

Loch a' Ghriama (see Plate III.).—Loch a' Ghriama (or Griam) lies immediately to the north of the head of Loch Shin, into which its waters are carried by a short rapid stream. The distance between the two lochs is only a quarter of a mile, and at the time of the survey there was a difference in level of nearly 33 feet. It is a good trout loch, and *Salmo ferox* is also found in it. The principal feeder is the Amhainn an Ceardaich, over a mile in length, bearing the outflow from Loch Merkland. It trends almost north and south, and is $1\frac{1}{2}$ miles in length, nearly uniform in width, the maximum breadth being over a third of a mile, and the mean breadth over a quarter of a mile. Its waters cover an area of about 260 acres, and it drains directly an area of over $6\frac{1}{2}$ square miles; but since it receives the outflow from Loch Merkland, its total drainage area is over $22\frac{1}{2}$ square miles—an area fifty-seven times greater than that of the loch. The maximum depth of 64 feet was observed approximately in the centre of the loch, but rather nearer the northern than the southern end. The volume of water is estimated at 314 million cubic feet, and the mean depth at 28 feet. The loch was surveyed on September 1, 1902, when the elevation of the lake-surface above the sea was found to be 303·7 feet, which is almost identical with the elevation observed by the Ordnance Survey officers on July 4, 1856, viz. 303·5 feet.

The conformation of Loch a' Ghriama is simple, with one or two very slight undulations of the lake-floor, the principal of which gives rise to a striking sinuosity in the 50-feet contour; otherwise the contour-lines coincide approximately with the outline of the loch. The 25-feet basin is about $1\frac{1}{4}$ miles, and the 50-feet basin over half a mile, in length. The longitudinal section C–D, and the cross-section G–H taken at the position of the deepest sounding, show generally a gradual slope down to the greatest depth, and this is borne out by the following table, giving the areas between the contour-lines and the percentages to the total area of the loch :—

Feet.				Acres.		Per cent.
0 to 25	...	...	...	121	...	47
25 „ 50	...	...	...	106	...	41
Over 50	...	...	...	30	...	12
				257		100

Temperature Observations.—The following series of temperatures, taken at 3 p.m. on September 1, 1902, in the deepest part of Loch a' Ghriama, indicates a range of only 2° from surface to bottom:—

Surface ...	...	...	...	...	...	...	57°·0 Fahr.
25 feet ...	...	...	...	...	...	...	56°·2 „
55 „ ...	...	...	...	...	...	...	55°·0 „

Loch Fiodhaig (see Plate IV.).—Loch Fiodhaig (or Fiodiag or Fiag) lies to the north-east of the head of Loch Shin, into which its superfluent waters are carried by the river Fiodhaig (or Fiag). This is a good trout loch, but the fishing is preserved, surrounded by moorland hills, with Ben Hee rising to the north. It receives the outflow from Loch a' Ghorm-Choire and another smaller loch lying to the north, which were not sounded. The loch trends in a north and south direction, and is over $1\frac{1}{2}$ miles in length, with a maximum breadth near the northern end of two-thirds of a mile. Its waters cover an area of about 370 acres, or over half a square mile, and an area twenty times greater—an area of over $11\frac{1}{2}$ square miles—drains into it. The maximum depth of 71 feet was observed not far from the largest island in the loch, and nearer the northern than the southern end. The volume of water is estimated at 415 million cubic feet, and the mean depth at nearly 26 feet. Loch Fiodhaig was surveyed on October 23, 1902, but the elevation above the sea was not determined by levelling; judging from the contour-lines, the lake-surface is apparently nearly 700 feet above sea-level. The loch is irregular both in outline and conformation. The lake-floor shows undulations, and in some places deep water approaches very close to the shore, as may be seen in the two sections on the map. The areas between the contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.				Acres.		Per cent.
0 to 25	...	...	...	203	...	55
25 „ 50	...	...	...	133	...	36
Over 50	...	...	...	33	...	9
				369		100

The temperature of the surface water on the date of the survey was 48°·0 Fahr. (the air-temperature being 51°).

Gorm Loch Mòr (see Plate V.).—Gorm Loch Mòr lies about 4 miles to the west of the head of Loch Shin, in a mountainous district, with

Beinn Leoid (2597 feet) to the north, Beinn Uidhe (2384 feet) to the west, and Ben More Assynt (3273 feet) and Coniveall (3234 feet) to the south. Its outflow is carried through a series of smaller lochs (Fionn Loch Mòr, Fionn Loch Beag, and Loch na Sròine Luime), which could not be sounded, into the river Cassley. Though a comparatively small loch, it has the distinction of being deeper than the other lochs in the basin, except Loch Shin. It is very irregular in outline, and includes many islands. The length of the loch, along a straight line from north-west to south-east, is slightly over a mile; but along a line following the deeper water it is considerably more. The greatest width in a north-and-south direction is over half a mile, the mean breadth of the entire loch being less than a quarter of a mile. Its waters cover an area of about 185 acres, or over a quarter of a square mile, and it drains an area of $5\frac{1}{4}$ square miles. Nearly seventy soundings were taken, the maximum depth of 91 feet being observed comparatively close to the western shore. The volume of water is estimated at 196 million cubic feet, and the mean depth at over 24 feet. The loch was surveyed on October 22, 1902, when the elevation of the lake-surface was found to be 837 feet above the sea; when visited by the Ordnance Survey officers on October 1, 1870, the elevation was 846·4 feet above sea-level.

The floor of Gorm Loch Mòr is most irregular, islands and banks and deep soundings being found here and there in close proximity, while in other places deep water approaches close to the shore. The contour-lines are of the most sinuous description, with isolated deep and shallow patches. The deepest part of the loch runs along the western shore, off which the slope is uniformly rather steep, and occurs towards the north-western end, as will be seen in the longitudinal section A–B on the map. The areas between the contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	126 ...	68
25 „ 50	35 ...	19
50 „ 75	16 ...	8
Over 75	8 ...	5
	185	100

Temperature Observations.—A surface reading at 10 a.m. on October 22, 1902, when commencing the survey, gave 44° Fahr., but at 2 p.m. in the deepest part of the loch a series of temperatures gave identical readings, viz. 46°·2, at the surface, and at 10, 25, 50, and 75 feet.

Loch Ailsh (see Plate V.).—Loch Ailsh lies about 10 miles to the west of Loch Shin, with the heights of Ben More Assynt and Coniveall rising to the north. It is a moderate-sized but rather shallow loch,

containing trout and an occasional salmon or grilse. It is irregular in outline, slightly under a mile in length from north to south, with a maximum width in the northern portion exceeding half a mile. Its waters cover an area of about 245 acres, and it drains an area forty-four times greater—an area of nearly 17 square miles. The maximum depth of 24 feet was observed in the north-eastern part of the loch, less than a quarter of a mile from the alluvial cone laid down at the mouth of the river Oykell on the northern shore. The volume of water is estimated at 88 million cubic feet, and the mean depth at $8\frac{1}{3}$ feet. The loch was surveyed on September 6, 1902, when the elevation of the lake-surface above the sea was found to be 498·5 feet, almost identical with that observed by the Ordnance Survey officers on August 29, 1871, viz. 498·4 feet. The highest drift-mark observed was 4 feet above the level of the water on the date of the survey. The southern and western portions of Loch Ailsh are covered by less than 10 feet of water, the deeper part lying along the eastern shore and towards the north-eastern angle of the loch. The area of the lake-floor covered by less than 10 feet of water is about 173 acres, or 71 per cent. of the entire area, while that covered by more than 20 feet of water is only about 12 acres, or 5 per cent. The temperature of the surface water at 2 p.m. on the date of the survey was 55°·3 Fahr., and a reading at a depth of 20 feet gave 54°.

Loch Craggie (see Plate V.).—Loch Craggie is a small but rather deep loch, less than 3 miles to the south of Loch Ailsh, the road from Oykell Bridge to Lochinver running along the northern shore. It trends in a north-west and south-east direction, is nearly two-thirds of a mile in length, and covers an area of about 45 acres. The maximum depth of 40 feet was observed approximately in the centre of the loch. The volume of water is estimated at 30 million cubic feet, and the mean depth at $15\frac{1}{3}$ feet. It was surveyed on September 23, 1902, when the elevation of the lake-surface was found to be 505·95 feet above the sea; when visited by the Ordnance Survey officers on August 26, 1871, the elevation was 506·5 feet above sea-level.

Loch Craggie is quite simple in conformation. The water is deep close to the shore all round, except towards the outflow at the south-east end, the area of the lake-floor covered by less than 10 feet of water being only about 15 acres, or 34 per cent. of the entire area; more than half of the bottom is covered by water between 10 and 25 feet in depth, while about 6 acres, or 13 per cent., are covered by more than 25 feet of water. Temperature observations taken at 3.30 p.m. on the date of the survey showed that the water was practically uniform in temperature from surface to bottom, the reading at the surface being 52°·8 Fahr., and at the depths of 15 and 30 feet, 52°·5.

Loch an Daimh (see Plate V.).—Loch an Daimh (or Damph) is situated about 7 miles to the south-west of Oykell Bridge, and about 8 miles to the east of Ullapool on Loch Broom. Though at present in the eastern watershed, the day may not be far distant when it will be diverted to the west, for the small stream flowing into the Rhidorroch river is cutting back rapidly, is much lower than the loch, and will probably tap the loch at its south-west end. The shores rise well above the loch, and the south-eastern shore is wooded; it is a good trout loch, but the fishing is preserved. Loch an Daimh is a narrow loch trending south-west and north-east, nearly 1¾ miles in length, with a maximum breadth of only one-fifth of a mile. Its waters cover an area of about 173 acres, or a quarter of a square mile, and it drains an area of about 2½ square miles. The maximum depth of 52 feet was observed approximately near the centre of the loch, but towards the south-west end. The volume of water is estimated at 205 million cubic feet, and the mean depth at over 27 feet. The loch was surveyed on August 23 and 25, 1902, when the elevation of the lake-surface was found to be 671·5 feet above the sea—identical with the elevation observed by the Ordnance Survey officers on August 1, 1870; during the winter of 1901–2 the water rose 2 to 3 feet.

Loch an Daimh is extremely simple in conformation, with no pronounced irregularities of the lake-floor. The 10-feet and 25-feet basins extend from end to end, and the 50-feet basin, half a mile in length, occupies a central position. The off-shore slope is in some places very steep, and the average slope outside the 25-feet contour is steeper than in the deeper water between 25 and 50 feet, as shown in the following table giving the areas between the contour-lines, and the percentages to the total area of the loch:—

Feet.	Acres.	Per cent.
0 to 25	77 ...	44·5
25 „ 50	87 ...	50·6
Over 50	9 ...	4·9
	173	100·0

The surface temperature on August 23, 1902, at 12.30 p.m., was 57° Fahr.; and on August 25, at 11.45 a.m., 56°.

Loch Migdale (see Plate VI.).—Loch Migdale is situated close to the northern shore of the Dornoch firth, and less than a mile from Bonar Bridge at the head of that firth. It contains trout and pike, and the surrounding scenery is very fine, a conspicuous hill called Migdale Rock, rising off the north-eastern shore. The island at the west end of the loch is artificial, composed of large and small stones; a crossing passes from the western shore to the island, and was covered by a foot of water at the time of the survey. The loch trends in a north-west and south-

east direction, and is nearly 2 miles in length, with a maximum width of nearly half a mile towards the north-west end, the loch narrowing gradually towards the opposite end. Its waters cover an area of about 260 acres, and it drains an area of about $7\frac{1}{4}$ square miles. The maximum depth of 49 feet was observed rather nearer the north-west than the south-east end. The volume of water is estimated at 242 million cubic feet, and the mean depth at over 21 feet. Loch Migdale was surveyed on September 24, 1902, when the elevation of the lake-surface was found to be 113·6 feet above the sea; when visited by the Ordnance Survey officers on November 1, 1869, the elevation was 115·1 feet above sea-level.

The loch forms a simple basin, with a few minor undulations of the lake-floor. The contour-lines approach nearer to the eastern end, where the Spinningdale burn flows out, the water being shallower towards the opposite end, with weeds growing off the northern shore, at the entrances of Migdale burn and Munroe's burn. The area of the lake-floor covered by less than 10 feet of water is about 70 acres, or 27 per cent. of the total area, while that covered by more than 25 feet of water is about 94 acres, or 36 per cent. Temperatures taken at 6 p.m. on the date of the survey, in the deepest part of the loch, showed very little variation in the temperature of the water, the reading at the surface being 54°·9 Fahr., at 25 feet 54°·1, and at 40 feet 54°.

Loch an Lagain (see Plate VI.).—Loch an Lagain (or Laggan) lies about $3\frac{1}{2}$ miles to the north-east of Bonar Bridge. It receives the outflow from Loch Laro (which was not sounded), and its superfluent waters are carried by the river Evelix, after a long winding course, into the Dornoch firth. It is a small, comparatively shallow loch, trending almost east and west, one mile in length, with a maximum width towards the western end of nearly a quarter of a mile, narrowing gradually towards the eastern end. Its waters cover an area of about 68 acres, and it drains a relatively large tract of country, the area of which exceeds 8 square miles—an area seventy-four times greater than that of the loch. The maximum depth of 18 feet was observed near the centre of the loch, but towards the northern shore. The volume of water is estimated at 23 million cubic feet, and the mean depth at $7\frac{1}{2}$ feet. The loch was surveyed on September 25, 1902, but the elevation of the lake-surface above the sea could not be determined; the Ordnance Survey officers levelled the loch on November 23, 1869, and found the elevation to be 446·2 feet above sea-level. The lake-floor is quite simple in conformation, with no irregularities, the deeper water approaching nearer to the eastern than to the western end; the area covered by less than 10 feet of water is about 49 acres, or 71 per cent. of the total area of the loch. The temperature of the surface water was 53°·0 Fahr., and a reading at a depth of 9 feet gave 52°·9.

Loch Buidhe (see Plate VI.).—Loch Buidhe (or Buie) lies amid moorland hills about 5 miles to the north-east of Bonar Bridge, the road from that place to Golspie running along its southern shore. It receives the outflow from Lochs Cracail Mor and Cracail Beag (which were not sounded), and flows, as already stated, into the head of Loch Fleet. It is a good trout loch, but an attempt to introduce salmon failed. The loch trends east and west, and is $1\frac{1}{4}$ miles in length, with a maximum breadth of nearly a quarter of a mile. Its waters cover an area of about 133 acres, and it drains an area of about $8\frac{3}{4}$ square miles—an area over forty times greater than that of the loch. The maximum depth of 36 feet was observed approximately in the centre of the loch. The volume of water is estimated at 68 million cubic feet, and the mean depth at $11\frac{3}{4}$ feet. The loch was surveyed on September 25, 1902, when the elevation of the lake-surface above the sea was found to be 528·45 feet; when visited by the officers of the Ordnance Survey on May 21, 1870, the elevation was 527·3 feet above sea-level. By means of the sluice at the east end of the loch the level of the water may be raised 4 or 5 feet, but it is seldom, or never, used; according to the keeper, the water may fall 2 feet below the level on the date of the survey.

Loch Buidhe is quite simple in conformation, the bottom sinking gradually on all sides from the shore to the deepest part, which occupies a central position. The area of the lake-floor covered by less than 10 feet of water is about 66 acres, or 50 per cent. of the total area of the loch, while that covered by more than 25 feet of water is about 4 acres, or 3 per cent. Temperature observations taken in the deepest part of the loch at 1.30 p.m. on the date of the survey showed little variation, the reading at the surface being 52°·6 Fahr., at 20 feet 52°·1, and at 30 feet 52°·0.

The particulars regarding the lochs dealt with in this paper are collected together in the following table for convenience of reference and comparison.

From this table it will be seen that in the eleven lochs under consideration, which cover an area of over 12 square miles, nearly 1600 soundings were taken, or an average of 129 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 14,500 millions of cubic feet, and the area draining into them is nearly 240 square miles, or twenty times the area of the lochs.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of sound-ings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Shin	270·85	815	17·22	1·12	0·51	3·0	162	51·0	31·5	561	1781	12,380	8·70	190·29	21·9
Merkland	360·2	115	3·02	0·37	0·23	7·6	85	30·1	35·5	188	529	577	0·69	15·94	23·1
a' Ghriama	303·7	80	1·50	0·37	0·27	18·0	64	28·0	43·8	124	283	314	0·40	22·60	56·5
Fiodhaig	—	47	1·61	0·68	0·36	22·4	71	25·8	36·3	120	330	415	0·58	11·66	20·1
Gorm Loch Mòr ...	847·0	68	1·39	0·52	0·21	15·1	91	24·3	26·7	81	302	196	0·29	5·21	18·0
Ailsh	498·5	89	0·95	0·58	0·40	42·1	24	8·3	34·6	209	604	88	0·38	16·83	44·3
Craggie	505·95	41	0·62	0·18	0·11	17·7	40	15·3	38·3	82	214	30	0·07	0·87	12·4
an Daimh	671 5	65	1·71	0·20	0·16	9·4	52	27·2	52·3	174	332	205	0·27	2·44	9·0
Migdale	113 6	104	1·92	0·41	0·21	10·9	49	21·2	43·2	207	479	242	0·41	7·21	17·6
an Lagain	446·2 [23/11/69]	60	1·00	0·23	0·11	11·0	18	7·6	42·1	293	697	23	0·11	8·14	74·0
Buidhe	528·45	80	1·27	0·22	0·16	12·0	36	11·7	32·6	186	572	68	0·21	8·70	41·4
		1564										14,538	12·11	239 69 *	19·8

* The drainage areas of Lochs Merkland, a' Ghriama, and Fiodhaig are included in that of Loch Shin.

NOTES ON THE GEOLOGY OF THE SHIN BASIN.

By B. N. PEACH, LL.D., F.R.S., and J. HORNE, LL.D., F.R.S.

Of the area included in the basin of the Shin, only narrow belts along the west, north, and east margins have been mapped by the Geological Survey. The greater part of the tract is occupied by crystalline schists of the types so largely developed in the counties of Sutherland and Ross, to the east of the line of complication which stretches southwards from Loch Eireboll by the headwaters of the Cassley and the Oykell rivers to Ullapool. The course of the Moine thrust—the most easterly of the great Post-Cambrian displacements described in the "Notes on the Geology of the Assynt District," * runs south from Gorm Loch Mòr by Loch Ailsh to near Loch Craggie, thence it curves westwards to Knockan beyond the limits of the Shin basin. East of this dislocation, the metamorphic rocks include quartz schists, quartz-biotite-granulites, garnetiferous muscovite-biotite schists and flaggy micaceous gneisses. These are pierced by igneous materials (granite and diorite) that cover considerable areas, as near Lairg.

Along the eastern part of the basin there is a belt of Old Red Sandstone strata running in a north-east and south-west direction, its western limit being approximately defined by a line drawn from the Mound station to a point west of Edderton station. Both the middle or Orcadian and the upper divisions of this formation are represented, the latter occurring between Tain and Tarbat Ness and northwards along the shore by Dornoch.

Gorm Loch Mòr.—This lake, situated in the high plateau east of Ben More, lies in a rock basin formed mainly of Cambrian quartzite. Part of the floor, where the Garbh Allt enters the loch, may be composed of thrust Lewisian gneiss underlying these quartzites. The deepest sounding is 91 feet, and at the outlet the water flows over ledges of the higher or "pipe-rock" zone of the quartzite. Around the lake, the traces of glaciation are extremely abundant. Both the striæ and the disposition of the carried boulders prove that, during the greatest extension of the later glaciers, the ice radiating from the east side of the Ben More range crossed the ridge in a north-east direction beyond Gorm Loch Mòr and overflowed into Loch Shin. At a later stage, the glacier that issued from Coire a' Mhadaidh curved round Cailleach an t-Sniomha on the west side of Gorm Loch Mòr, and moved north-west by Glen Beg to the head of Loch Glencoul. The quartzite plateau in the east part of the lake is dotted over with moraines, which there form the islands.

Loch Ailsh is a shallow lake—the greatest depth being 24 feet—partly enveloped in drift and solid rock. It rests on various zones of Cambrian age, including the quartzite, Fucoid beds, serpulite grit, and limestone with intrusive igneous materials, all overlying the Ben More thrust-plane. From the covering of drift, it is uncertain whether this lake is a true rock basin. Its surface level is 498·5 feet, and the rock first appears at the outlet at a height of 490 feet above Ordnance datum line.

Loch Craggie is a true rock basin, the deepest sounding being 40 feet. The rocky barrier is formed by siliceous schists and mica-schists that are well exposed in the stream below the outlet and by the side of the road along the north bank of the lake. The height of the surface of the water above sea-level is 505·95 feet, and that of the solid rock where the bridge spans the Craggie burn below the outlet is 505 feet. The direction of the ice-movement during the later glaciation was parallel with the long axis of the lake.

* See *Geogr. Journ.*, vol. **23**, p. 461, April, 1904.

Loch an Daimh lies along a line of dislocation or fault that has been traced for a long distance in the crystalline schists south-westwards towards the head of Loch Broom. In the streams draining the hill slope on the northmost side the strata are exposed, which there consist of quartzose granulites with intercalations of mica-schist. On the higher part of the declivity the beds dip at gentle angles to the south-east, but on approaching the lake they are thrown into rapid folds parallel with its long axis, and are much crushed and shattered. At its lower end the lake is invaded by cones of alluvium brought down by the streams on either side.

NOTES ON THE BIOLOGY OF THE LOCHS OF THE SHIN BASIN.

By JAMES MURRAY.

Collections of plankton were made in eight lochs of the basin. The lochs are mainly characterized by the presence of two northern species of *Diaptomus* (*D. laciniatus* and *D. laticeps*), besides the common *D. gracilis*, and by the very numerous Desmids, many of which are of the western type.

Each of the three species of *Diaptomus* was found in five lochs—*D. gracilis* in Lochs Shin, a' Ghriama, Ailsh, Gorm Loch Mòr, and Fiodhaig; *D. laciniatus* in Lochs Shin, a' Ghriama, Merkland, Ailsh, and an Daimh; *D. laticeps* (or a related species) in Lochs a' Ghriama, Ailsh, an Daimh, Gorm Loch Mòr, and Fiodhaig. All three species occurred together only in two lochs, a' Ghriama and Ailsh, while in all the other lochs, except Merkland and an Lagain, there were two species; in Loch Merkland *D. laciniatus* was the only species seen. *D. laticeps* was identified in Lochs a' Ghriama and Ailsh; in Lochs an Daimh, Gorm Loch Mòr, and Fiodhaig, a species of the same group occurred, but as only females or immature males were seen, it is not certain whether they were *D. laticeps* or the very closely related *D. wierzejskii*.

Among other Crustacea there is little to note—*Holopedium* was only seen in Lochs Shin and a' Ghriama; *Leptodora* in Lochs Shin, a' Ghriama, and an Daimh; *Sida* in Loch a' Ghriama only; *Diaphanosoma* in nearly all of the lochs. Nearly all the *Daphniæ* of Loch Fiodhaig were males.

Ilyocryptus acutifrons, G. O. Sars, was found in Loch Shin in August, 1903, being previously unrecorded for Great Britain. It was obtained in a shallow bay at the mouth of the Fiodhaig river.

The Desmids of Loch Shin have been fully studied by Messrs. W. and G. S. West.* On the occasion of our visit the very great abundance, of individuals as well as species, was remarkable, exceeding anything that we had observed in other lochs. In Lochs a' Ghriama and Merkland the species were also very numerous, and on the whole the same as in Loch Shin. In Lochs Ailsh, an Daimh, and an Lagain, few Desmids were seen, but all had some of the western species. In Gorm Loch Mòr and Loch Fiodhaig no Desmids were noted.

Pelagic Rotifera were abundant only in Lochs Shin, a' Ghriama, and Ailsh; in Loch Shin the plankton collections also included many littoral species, which must have been driven out by the stormy weather. *Floscularia pelagica*, Rousselet, was in Loch a' Ghriama only. Skeletons of the Heliozoan, *Clathrulina elegans*, were abundant in Lochs Shin and a' Ghriama.

* See *Journ. Linn. Soc., Bot.*, vol. 35, p. 519, 1903.

THE ALEXANDER-GOSLING EXPEDITION IN THE SUDAN.

THE following communication has been received from Lieut. Boyd Alexander, dated "River Shari, May 26, 1905:"—

The expedition has received a rather serious check as regards its forward movement, owing to the difficult navigation of lake Chad. Having got together a sufficient number of bullocks to carry the heavy loads by land to Kusseri, I left our camp at Kadde, close to the lake, with Gosling on February 12. A few days later I left with my collector Lopes in the two boats to find a waterway from Kadde to Kusseri. I reached the Yo mouth on February 27. The river was still running, but had fallen considerably, and in places it was fordable. My journey thus far buoyed me up considerably, as I found open water with an average depth of 3 feet. From the mouth I struck in an easterly direction, and all went well for two days, during which I covered approximately 20 miles. But on the third day trouble commenced. I could not find more than a foot of water—covering unfathomable thick black mud. I could find no open water, nothing but a mass of small islands, which formed innumerable shallow bays. These islands are not of large extent; their average length does not exceed a mile. They are low, of a sandy soil, and covered with scrubby bush-growth and reed, not a few being fishing-stations where the Budumma dry their fish. On the larger ones there are cattle stations, which consist of reed-built huts of Kaffir-kraal shape, very small in circumference, and not more than 4 feet high.

It was most disheartening work—finding sufficient water for the boats one day, only to discover the next morning that it had left one nearly high and dry in the mud. This generally occurred after a strong wind from the north-east, but not always so. At night the water, independently of any wind, used frequently to fall as much as 6 inches; and then towards mid-day it would commence to flow again, and be at its full about three o'clock. On several occasions I found traces of currents running in a south-easterly direction, at the rate of a mile an hour.

In my struggle to get across the lake, one of the worst things I had to face was the mosquitoes, which swarmed in clouds, making it a perfect hell upon earth. On March 20 I returned to Kadde, and made preparations for a second attempt in a due easterly direction from this place. But, to cut a long story short, I met with the same ill success —no water after 25 miles, only groups of small islands, behind which was a long tract of land running in a north-westerly direction, and which I was unable to skirt. This, I fully believe now, forms the east coast of the lake. This land to the south bends round in a semi-circle to within 5 miles of Kadde, when dense masses of reeds connect it with the mainland. I have now no doubt whatever, and the Budumma

tell me the same thing, that this land divides the lake in two, and there is no water-communication between the two sides.*

I made an attempt to cut my way through the reeds I have just spoken of, but the growth was so dense that I had to give it up and return again to Kadde, where no other course was left to me but to take the boat to pieces and carry them 30 miles to a Budumma fishing-station close to the lake, where I learnt that the water was more open. What with sickness and desertion, I found myself left with only seven men, and it was a good month before I could get everything up to the fishing-station and the boats put together again.

The Budumma call this place Seyurum, which they say was once an island, but is now part of the mainland. On reconnoitring the water near this place, I found that this seemingly open water, averaging a depth of 4 feet, was nothing more than a large bay, enclosed on every side by great belts of reeds, 5 to 6 feet high, and clumps of maria bush, growing out of water 2 to 3 feet deep. There was nothing for it but to cut a road for the boats. A day's cutting through the reeds in a north-easterly direction brought me out again into another large bay of the same aspect as the first. The next cutting was still more serious, and took me two days; but after that I found pretty deep water, averaging a depth of 5 feet. There is now a clear road between our side and Kanem, with water sufficient for a launch drawing 2 feet.

Up to this time the Budumma had held severely aloof, but now a kachella, or chief, of a large fishing fleet we met, came forward and offered to show us the road to Bul, a French station on the Kanem coast. After getting out of the thick reed-belts the aspect of the lake presented quite a different look from that of the Yo side. The small low flat islands of the latter gave way to big island stretches, with channels sometimes not more than 100 yards wide, at other times forming bays as much as 2 miles in width, lined with belts of dark-green maria 10 to 30 feet in height, and relieved by the reddish-brown feathery branches of a thornless acacia. A day from the reeds brought us to Karraragga, the island of the kachella, who took us to his town, a rather pleasing event after having struggled for nearly two months to get a glimpse of one. This island presented a very fertile appearance—most refreshing to the eye after the sand-swept stretches of Bornu.

This kachella's town consisted of reed-built huts, conical in shape right down to the ground. Each hut had its low round mosquito house, covered with close-woven matting. The Budumma all speak Kanuri or Beri-Beri. They come very close to the Kanembu, with whom they intermarry. They are tall men, with well-developed heads and foreheads,

* This seems to imply that the lake has fallen still further since Captain Lenfant's expedition navigated it. That officer's map (*La Géogr.*, June, 1904) shows a strip of navigable water running quite down the west coast and across towards the Shari mouth.

but blunt noses, and, living as they do on fish, their skins are very sleek and oily. As to dress, the men wear the loose-fitting dark-blue toga of native cloth, common in Bornu, which they get in return for their fish in the Koa market. The women are small, and in their headdress resemble the Kanembu.

The Budumma are not a fighting race; they are timid, and certainly a good deal of my trouble has been in trying to make friends with them. They drive their canoes along at a prodigious rate, youths and small boys doing all the work of poling. Their canoes—made of bundles of dried reeds tied together and turned up at the prow—are most picturesque, especially when one sees a number together, which is generally the case, the people visiting their fishing-grounds in large fleets of from twenty to thirty boats. The Budumma catch the majority of their fish in nets, but the larger ones of 3 feet and upwards in length are speared. Most of the fish are dried and taken to the Bornu markets.

The Budumma on the Shari side are a much more enlightened lot of people than those on the Yo-Chad water, whom the former despise, and who are a bush people, coming, from what I can make out, from a country called Kologo, in the north-east of Kanem. They are nothing more than robbers and slave-dealers, and the sooner they are taken in hand, the better it will be for our rule in Bornu. The eastern Budumma have their chiefs, who are called kachellas, while over all these is the king, who is called the korammi. They are well-to-do people, deriving their wealth from the potash trade and their dried fish. To return to my journey. A distance of 10 miles from Karraragga brought me to a place called Wunda, a Kanembu town on the Kanem coast. It came as a great surprise to me that I was able to reach the other side of the lake in practically two days, and, speaking approximately, the distance is not more than 20 miles, so that a boat can now reach the Kanem side from Koa in a day. Shrinkage of the water must have a great deal to do with it. Many of the islands I passed are now practically one, great belts of reed and grass joining them. At Wunda I found a large amount of potash, which comes a five-days' journey from the Kanem country, and is taken by the Budumma in their canoes to the Bornu markets, where it forms a very lucrative trade, well worthy of protection. Kanem looks a most desolate country, nothing but sand-dunes covered with scrubby acacia growth, whose branches are whitened by the wind-swept sand. All the towns I stopped at were in want of food, and it was with difficulty I could get any for my men. From Wunda I reached Bul, a French station on the Kanem coast, about 8 miles to the south-east.

From this place, after skirting the Kanem coast for a distance of 12 miles, I struck in a westerly direction. This course was difficult, winding through belts of maria that frequently closed together and gave the waterway a width of not more than 100 yards. In these channels I found 9 to 12 feet of water, but soon reed-growth reappeared,

and made it necessary to cut a path. At last my Lake Chad troubles ended, for I arrived yesterday at the Shari mouth, after three months' knocking about on the lake. I am sending you from Kusseri, for what it is worth, a map of my first route from the Yo mouth; the others I shall not have time at present to plot. I have made a rather interesting collection of birds on the islands. They differ very considerably from those I collected in Bornu.

From what I have seen of the Shari so far, it is a magnificent little river, but cannot be compared with the Benue in size, the average width being 500 yards; but unlike the Benue, it is quite free of sand-banks. Coming up the river, all the chiefs have shown the greatest hospitality. At present they are between two stools, the Germans on one side and the French on the other. Many of the big chiefs have land and towns on both banks, and the result is a constant source of trouble. Demarcation of territory out here by fixed boundaries, like rivers, seem to me absolutely wrong. Boundaries should be determined by the territories owned by the big chiefs.

Writing from Fort Lamy, June 14, Lieut. Boyd Alexander says—

"I am sending you from here two of my route maps—one from the Yo mouth, the other of the crossing from Seyurum to Bul. According to my course, I cannot make the distance across more than 41 miles, and, approximately, as the crow flies, 30 miles. I have taken all the trouble I could to get the distances as accurately as possible. All the same, my distance across does not tally with that of the present French map which I have seen here, the distance being 60 miles on the latter.* I believe I am the first to cross the lake from our side, so the distance will at present remain *en l'air* till we know the exact positions of Seyurum † and Bul, or rather Munda, which latter place was the first I touched on the Kanem side. The French have just sent up an officer to fix these places and to find my route, with the idea of getting through by it to the Komadugu, but from what I have seen of the lake I think this is impossible. Two years ago the French had a route skirting the Kanem side up to the north end of the lake to their station at Ngegmi, but now there is no water on this road.

"Gosling and I are leaving in the boats to-morrow for the Gribingi, whence we go down the Tomi, and then a porterage of six days will bring us on to the Ubangi. The French have shown us splendid hospitality. Our stores and provisions are lasting out pretty well. We have another six months' supply. We hope to reach the Ubangi by the end of August."

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* Captain Lenfant's map, which Lieut. Alexander had of course had no opportunity of seeing, makes the distance across from the west to the east coast generally under 25 miles, and in one part only about 25 miles.

† The work of the Anglo-French Commission and that of my expedition in Bornu should fix this place.

STATISTICAL ATLAS OF THE UNITED STATES.*

NOTHING is more worthy of commendation than the pains taken by the census department of the United States to present the facts ascertained by the decennial statistical inquiries in the form in which they are likely to be of most use. Statistics are merely raw materials. Their principal use in the great majority of cases is to suggest further inquiry, and this is particularly true of the statistics usually collected at national censuses. That subjects for fruitful investigation may be suggested, it is important that the main facts resulting from the census inquiries should be set forth in such a manner as to catch the attention of the inquirer. Admittedly this is best effected by means of graphic representations, and this is what we have here on a lavish scale. The results of the last census of the United States are here presented on 207 plates each measuring 11½ by 9 inches, and the interest of these plates to the geographer is shown, if by nothing else, by the fact that a large proportion of the graphic representations on these plates are in the form of maps, in many cases six maps on a single plate. The plates are accompanied by a text of 67 pages consecutively numbered from 25 to 91, but interspersed in sections through the volume under different headings, such as population, vital statistics, agriculture, etc. There is also a table of contents and a list of illustrations, occupying together 18 pages.

Different inquirers will look with different degrees of interest on the facts presented by the various plates, and it will therefore be worth while to indicate as fully as possible the contents of the plates, and to draw attention to some of the more striking of their indications.

The first plates are historical, No. 1 showing the successive accretions to the territory of the United States as originally defined by the treaty of 1783, and Nos. 2–12 showing the distribution of population at each of the previous censuses. In these all towns with a population of 8000 and upwards have their position indicated, and it is interesting to notice the first emergence of now populous cities. Cincinnati first appears as a town ("city") with upward of 8000 inhabitants in 1820. Pittsburg and Buffalo have attained that limit by 1830, but St. Louis is still below it. Both St. Louis and Chicago are added to the list in 1840, and Milwaukee appears in 1850. In 1860 St. Paul is indicated as a city above the 8000 limit, but Minneapolis not till 1870, when many other western towns (Des Moines, Council Bluffs, and Omaha; St. Joseph, Leavenworth, Lawrence, and Kansas City; Salt Lake City; San Francisco, Oakland, San Jose, Sacramento, Stockton, Portland, Ore., and others) are also so marked for the first time.

Plate 13 shows the density of population as ascertained by the last census, and plate 14 is a diagram, based on the *Geographisch-Statistische Tabellen* of Juraschek, showing the increase of population of the United States as compared with that of several European countries, to which it would have been interesting to have added another showing the relative rate of increase in the same countries.

Plates 21 and 22 are ingenious coloured diagrams showing the relative ranks of the states and cities respectively at the different censuses. Though rather complicated, they are probably the simplest that could have been devised for the purpose. It may be noted that on the second of these two diagrams there appears the city of Moyamensing in the censuses from 1830 to 1850, at which it held the twenty-eighth place, after which it never reappears. It does not find a place in Colange's *Gazetteer of the United States*.

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* 'Twelfth Census of the United States, taken in the year 1900.' William R. Merriam, Director. Statistical Atlas. Prepared under the supervision of Henry Gannett, Geographer of the Twelfth Census. Washington: 1903.

Plate 25, a map showing the density of increase of population in different parts of the United States between 1890 and 1900, is of peculiar interest. This period was notoriously one of great prosperity for the United States as a whole, prosperity shown by the enormous development of important industries and a very rapid increase in its foreign commerce, and especially in the value of its exports of manufactured goods, a circumstance to which some people attach special importance. Yet it is already a familiar fact that there was a smaller ratio of increase of the population of the country in that than in any previous intercensal period, and this map shows at a glance that there were considerable areas in different parts of the country where there was an absolute decline of population during that period. Most striking of all is the fact that one of the largest of those areas is in the state of New York, extending from the Hudson to the shores of Lake Ontario, and to the vicinity of those of Lake Erie, embracing in all about half the extent of the state, equal to fully three-fourths of the area of Ireland.

Plate 26 is a map showing the proportion of the population in towns of 2000 inhabitants and upwards. That the most extensive area with a large proportion of the population so distributed should be the north-east quadrant (north of 38° N. and east of 97° W.) is only what was to be expected, but the vast extent of the territory in the south-east with no towns above 2000 is very striking, all the more so since this very area is shown by plate 28 to have had in many parts an exceptionally large percental increase of the population.

Plate 42 is made up of a number of circular diagrams proportional in area to the total population at each census, and indicating also the elements of which the population is made up. The earlier diagrams distinguish only the white and coloured population, but the last four distinguish the native whites born of native parents, native whites born of foreign parents, foreign-born whites, and coloured. Neither on the plate nor in the text, however, is it stated to which side those of mixed parentage are referred. From these diagrams it appears that in the last three decades the proportion both of the native whites of native parents and of coloured has been declining, while the other two elements have relatively increased in numbers. In connection with this plate it is of interest to examine plate 87, which contains a diagram in the form of a square of 5 inches, on which the occupations of the people are classified by race and nativity. Agricultural pursuits, professional service, domestic and personal service, trade and transport, and manufacturing and mechanical pursuits are distinguished by five colours, while the four elements of the population enumerated under plate 42 are represented by four horizontal sections proportional to their numbers. If the square had been marked off in hundredths on two sides at right angles to one another, it would have been easier to compare the magnitude of different sections, but even without that aid one cannot fail to notice what a large proportion of the agricultural class is made up of natives born of native parents, and, on the other hand, what a large contingent is furnished to the manufacturing and mechanical section by foreign whites and native whites of foreign parentage. To this section these two elements of the population furnish together a much larger number than that furnished by the other two elements.

Plates 50 and 51 relate to migration and immigration. Plate 50 gives the net results of migration by states and of immigration from abroad and emigration to foreign countries on the population of the different states. As the result of interstate migration only, the states Virginia, Kentucky, Tennessee, North Carolina, Georgia, and South Carolina, showed a loss amounting in each case to upwards of 150,000, while New York, Massachusetts, Illinois, Texas, California, New Jersey, Pennsylvania, and Kansas each gained to the extent of at least half a million. Plate 51, which shows by states the amount of interstate emigration and immigration

separately, presents a vivid picture of the present instability of the United States population. In this way New York lost by migration to other states 1,290,000, and gained by entrance from other states about 540,000; Illinois lost 1,013,000 and gained about 960,000; Ohio lost 1,114,000 and gained rather more than 500,000; Missouri lost about 615,000 and gained about 855,000; and Pennsylvania lost about 940,000 and gained about 490,000. This means in the case of Ohio, for example, that, if we take the mean between the population of that state as it was in 1890 and 1900, more than 28 per cent. of the population left the state in that interval, while nearly 13 per cent. were added during the same period.

Plates 53 and 54 relate to the negro population, and Plates 57 to 69 to the foreign-born population. Plate 79 shows the somewhat surprising result that the proportion of illiterates among the native white voters exceeded 10 per cent. in the greater part of the south-east and 25 per cent. in not inconsiderable areas, while plate 80 shows, as was to be expected, a much higher percentage under this head for the negro population, the proportion of illiterates being more than one-half in by far the greater part of the coloured area. Plate 86 shows that in three states, New Mexico, Arizona, and Texas, the number of persons above ten years of age who could not speak English exceeded 25 per cent. of the total population.

Plate 98 is a map showing the average size of families—greatest towards the mouth of the Mississippi valley and in the middle Appalachians (West Virginia), least in the north-east and on the Pacific seaboard—least of all in northern New York and between the south-east of Lake Michigan and Lake St. Clair. Plates 99 and 100, the last under the head of population, show by states—the former the proportion of houses, the latter the proportion of farmhouses owned free, encumbered, and hired in 1900.

Plates 101 to 125 relate to vital statistics, and exhibit, partly on maps and partly by diagrams, the death-rate from various diseases in the registration area for 1900, that is, in the states of New England, in New York, New Jersey, Michigan, and the district of Columbia, together with 153 cities with a population of 8000 and upwards.

Plates 126 to 178 relate to agriculture. The first of these shows the centres of production for maize, wheat, and other products compared with that of manufactures. Plate 129 is a map showing in five tints the average size of farms in different parts of the United States, the lowest tint indicating farms of less than 80 acres on the average, the highest those of more than 640 acres.

Plates 132 to 138 relate to the improvement of land. Plate 132 shows the proportion of improved land to the total area in different parts of the United States, and one of the maps in plate 138 shows the same by states. The greatest proportion of improved land (75 per cent. of the total area and upwards) is found in the north prairie states, from the western frontier of Pennsylvania to eastern Nebraska. Plate 133 shows the difference in farm values at the beginning and end of the five intercensal periods since 1850, and may be compared with advantage, as regards the last period, with plate 25. It shows an increase in farm values in all the states represented between 1850 and 1860. The decline throughout the south-east in the next decade is of course accounted for by the civil war. Between 1870 and 1880 there was a decline in values only in Vermont, New Jersey, and Delaware, but it is noteworthy that between 1880 and 1890 there was an aggregate decline in farm values in all the states from Maine to New Jersey in the east and between the seaboard of those states and Indiana (Indiana not included) in the west, but in no other states, and that between 1890 and 1900 the decline was continued in Maine, New York, Pennsylvania, and Ohio. In that period Florida also showed a decline.

Plate 142 gives a classification of farms by tenure, distinguishing farms cultivated by the owners, farms in the hands of cash tenants, and those in the hands of share tenants. From this diagram it appears that farms cultivated by their owners formed less than half the entire number only in Alabama, Louisiana, Georgia, South Carolina, Mississippi, and the Indian Territory. Only in the Indian Territory did share tenancies exceed one-half the number, and, in addition, only in Texas and Delaware did such tenancies exceed 40 per cent. of the total.

Plates 146 to 149 relate to the rearing of livestock. From these it appears that swine were most numerous (100 or more per square mile) in the greater part of the area between 38° and 43½° N. and 83° and 99° W. (plate 146); neat cattle most numerous (75 and more per square mile) west and south-west of Lake Michigan (plate 147); sheep (50 per square mile and upwards) chiefly in the area between Pennsylvania and the south-east of Lake Michigan (plate 148); while horses, mules, and asses were found to the number of 25 per cent. and over throughout the north-east (plate 149).

Plates 153 to 177 relate to the production of various crops. The aggregate production of all grains per square mile was greatest in Iowa and Illinois (plate 153); that of maize (plate 154) in much the same area as that which reared the largest number of swine; that of wheat (plate 156) greatest south-east of Lake Michigan, in the western prairie states and on parts of the Pacific seaboard, as well as in the north-east of Oregon, and the south-east of Washington, but very scanty (under 64 bushels per square mile) in a very large, almost unbroken area south-west of Lake Michigan, in Illinois, eastern Indiana, and the north-east of Missouri. Oats (plates 158, 159) were very generally and largely cultivated throughout the north-east quadrant of the States except in most of the New England states, and it is noteworthy that they were much grown in the maize area south-west of Lake Michigan, where the cultivation of wheat was very sparse. Rye (plate 160) was grown in three principal areas—(1) north-west of the seaboard stretching from Chesapeake Bay to Long Island sound, (2) on both sides of Lake Michigan, and (3) in eastern Nebraska. The principal barley area (plate 161) was from the middle of Lake Michigan to the west of S. Dakota. Hay and forage crops (plate 162) were plentifully grown throughout the north-east, most abundantly between Lakes Erie and Ontario and the coast.

The cotton area seems scarcely to have passed beyond the limits reached in 1860, although it is difficult to compare the maps compiled at the different dates, as the earlier maps indicated the proportion of the surface occupied by cotton, while one of the two cotton maps (plates 165, 166) for 1900 shows no cotton-growing district where less than one bale per square mile was grown, while the other shows only the yield per acre. The latter shows the most extended area, with an outlying patch in about 38½° N. in Virginia, and another, where it is grown by irrigation, in the adjoining parts of Arizona, Utah, and Nevada; while in the south the continuous cotton area as thus shown extends to the Rio Grande in the south-west, and to Tampa in Florida. The area within which as much as one bale per square mile was grown is very compact, nowhere rising much beyond 37° N., excluding most of Tennessee to the east of the part of the Tennessee river which flows north, so as not to rise in most of that state beyond 35° N., and touching the coast in the east only in North and South Carolina, and in the south only to the south-west of New Orleans and the south-west of Galveston. In the west it extended in one point, about the middle latitude of Texas, beyond 101° W. The more considerable parts of this area yielding above 35 bales to the square mile were four in number—one on both banks of the Mississippi reaching from about the northern limit of the area to near New Orleans; a second curving, with convexity to the south-east, from the

angle in the north-west of South Carolina to about the middle of southern Alabama (32° N.); a third, behind the previous, stretching from about the north-east of Georgia south-westwards to about the middle of the eastern frontier of Alabama; and the fourth, in Texas, stretching south from the Red river between 96° and 98° W. It is this last area that shows the greatest advance in productiveness in recent years.

The map showing the production of tobacco per square mile (plate 167) presents a great contrast to that of cotton. The most productive districts, instead of being in a compact area, are scattered over the eastern half of the country, one in the east of North Carolina, a second in the north-west of North Carolina and the adjoining part of Virginia, a third in the south-east of Pennsylvania, a fourth in the south-west of Ohio and eastern Kentucky, a fifth in the south-west of Kentucky and the adjoining part of Tennessee, a sixth in Wisconsin, about 30 to 40 miles to the west of Lake Michigan, crossed by 43° N., and a seventh in the middle of northern Connecticut.

Other maps (plates 173–177) show the production of potatoes and sweet potatoes, apples and pears, cherries, grapes, peaches, apricots, plums, and figs; but it is somewhat surprising and disappointing to find that there is neither map nor diagram to illustrate the distribution of citrus fruits, the vicissitudes of which in past decades are a matter of no little interest in the agriculture of the United States, or that of rice or sugar, whether cane or beet.

Plate 178 furnishes by means of diagrams, but unfortunately no map, a variety of information with regard to irrigation. The greatest extent of irrigation in 1899 was in the state of Colorado, where about 2,000,000 acres, or 3 per cent. of the entire surface, were irrigated, California coming second with less than 2,000,000 acres, and accordingly less than 2 per cent. of the area, which is just under 100,000,000 acres.

	Number of irrigators.	Acres irrigated.
1889	52,584	3,564,416
1899	102,819	7,263,273

The total cost of irrigation in 1899 was about 61,300,000 dollars, the total value of the irrigated crops 84,400,000 dollars.

Plates 179 to 207 relate to manufactures, but some of these it is impossible to interpret with certainty, there being no adequate explanation either on the maps or in the text. On p. 85 there is a reference to p. 37 of the text for a full description of the method of computing the centre of manufactures, but there we find nothing of the sort. All that we do find is an account of the method of computing a centre (of population); but we are told that the centre of manufactures is based on the value of the gross products, and what we want to know is, how this value is determined. From plate 193 we learn that men's and women's clothing was the fifth in the value of its products among the manufacturing industries of the United States in 1900. Now, among these manufactures there must have been large quantities of worsted garments, the production of which involves several successive manufacturing industries. We have first the combing of the wool, then the spinning of the combed wool into yarn, the weaving of the yarn into cloth, and finally the making of the clothing. But if the products of all these industries are added together to give the value of the gross products of manufactures, it is obvious that the same values must be reckoned in several times. That some of these industries are separately entered is obvious from the fact that cottons appear on the same plate as the seventh, and woollens (no doubt including worsteds) as the ninth in point of the value of their products among the industries of the United States. On plate 180 we have a statement of the total

value of manufactures less the cost of materials; but this again leaves us in perplexity, for if the values of the products of all the industries separately entered are added together after the deduction of those of the raw materials, it is evident that the same values must be deducted several times.

We cannot but think that many of the maps and diagrams under the head of Manufactures might have been dispensed with, and replaced with advantage by others relating to the mining industries of the United States, on which this volume gives us no information. The inclusion of large-scale maps indicating both the quantity and value of the principal economic minerals produced in different parts of the United States would have been very welcome.

G. G. C.

THE MECHANICS OF VOLCANOES.

THE mystery of the volcano has always attracted the human intellect, and, from the days of Empedocles onward, has been an object of investigation and speculation. Many are the theories which have been broached, none of which gave a complete explanation, and most of which have been more or less completely abandoned as the advance of knowledge showed the baselessness of their foundations, or their want of agreement with observation. This same advance of knowledge has enabled us to come nearer to a true explanation, and the latest attempt to solve the problem is contained in a paper by Prof. C. Doelter.* His explanation is not completely satisfactory in detail, yet it probably represents an approximation to the truth, and, as such, deserves the attention of geographers, for an appreciation of the cause of volcanic activity—though, strictly speaking, this is a branch of geology—is essential to the proper understanding and classification of the forms of volcanoes.

Prof. Doelter's explanation is based on the results of recent physico-chemical investigations, and involves two main principles, the first of which is the variation of melting-point with pressure. The lava of Vesuvius melts at a temperature of about 1900° Fahr. (1050° C.) under ordinary atmospheric pressure, but when subjected to greater pressures the temperature at which fusion takes place rises at the rate of about one-twentieth of a degree for each atmosphere; this increase is not, however, continuous, for there can be little doubt that in the case of lava, as of other substances, the rise of melting-point gradually reaches a maximum, after which any further increase of pressure leads to a lowering of the melting-point. As both pressure and temperature increase with depth below the surface, there must come a level below which all rocks are in a state of fusion, but it is not probable that this maximum melting-point is of practical importance, for even if we take the mean rate of increase of temperature at only one-fifth of the mean observed rate near the surface, which is about one degree Fahrenheit in 60 feet, the increase of underground temperature would overtake the rising melting-point at a depth of not more than 70 miles, while the maximum melting-point would not be reached under a depth of from 100 to 200 miles.

From these considerations, it follows that below the outer crust of cooled and solidified rocks there must be a larger zone of rock which still remains solid, because its temperature is less than that of the melting-point corresponding to the

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* "Zur Physik des Vulcanismus." *Sitz. ber. K. Akad. Wiss. Wien*, 112 (1903) pp. 681–705.

pressure under which it rests, and below that again there must be rock or magma in a state of fusion; it is to this magma that Prof. Doelter looks for the original, or primary, source of all volcanic activity. At the same time the depth at which this primary reservoir of magma lies, and the pressure under which it is confined, are so great that a direct eruption from it is inconceivable, but when, by movements in the overlying crust or otherwise, a channel is opened, the magma may rise to a depth where it is surrounded by rock at a lower temperature than the melting-point. In these circumstances solidification commences, and the second principle comes into play, and, if the depth below the surface is not too great, is the direct cause of an eruption.

This second principle is the separation of aqueous and other vapours from the solidifying magma.

From all volcanoes large quantities of steam, of carbonic acid, and other gases are evolved, and the course of every lava-stream is marked by clouds of steam evolved from the cooling lava. At one time—and the idea is still common—this steam was supposed to have been derived from sea-water which had obtained access to the molten lava while still underground, but this explanation is now generally rejected, being impossible in some cases and inadequate in all, and the greater part of the steam and other emanations from a volcano are now regarded as directly derived from an original store in the interior of the earth. However this may be, it is certain that the magma from which volcanic lava is derived is not merely in a state of igneous fusion, but is combined with water and gases, which are given off as it solidifies, and by their escape frequently form miniature volcanoes, or *hornitos*, on the surface of lava-streams. If the solidification takes place underground, the steam and gases are expelled in the same way, and, if there is no free escape, pressure may increase, till it becomes great enough to overcome the resistance of the overlying rock, and so lead to an eruption and the formation of a volcano, whose character will depend on the nature of the reservoir from which the eruption took place.

This solidifying reservoir of magma, forming the secondary or immediate source of volcanic activity, may be one of those masses of magma intruded through a narrow channel of communication, which solidify into the laccolites of geology. In this case the narrow channel of communication with the central source will solidify while the overlying accumulation remains fluid, and as this solidifies the included steam and vapours are expelled. If these vapours have a means of escape through crevices in the overlying rock, they may give rise to fumaroles or hot springs, otherwise pressure will increase and may become sufficient to force a way to the surface, giving rise to one of those circular depressions known as pit-craters, or to a simple volcanic cone of the character of the "puys" of Auvergne. The opening of a passage to the outer air relieves the pressure on the solidifying magma, the melting-point is correspondingly reduced, and part may pass back into a liquid state, expanding as it does so, and by this expansion a quiet extrusion of lava may follow the explosive stage.

Volcanoes of either of the types mentioned are distinguished as monogene by Prof. Doelter. Their activity is almost always limited to a single outbreak, though a large reservoir may give rise to a second or even a third eruption during its solidification; in any case, the term of activity is necessarily limited, for as soon as the molten magma has completely solidified the source of energy is exhausted, and no further eruption can take place.

This explanation is inapplicable to great volcanoes, like Vesuvius, built up by a countless series of eruptions succeeding each other intermittently over a long period of time; here no isolated reservoir, however capacious, could conceivably

suffice for the calls on it, and we must look to the great original source of molten magma in the interior of the Earth, from which there must be a wide channel of communication to those depths from which an eruption can take place. In this channel magma rises to levels where the temperature falls, solidification commences, and the vapour tension rises till it is sufficient to drive out the overlying magma, whether solidified or still fluid, and so give rise to an eruption; this leads to a lowering of pressure, and consequently of melting point, the solidifying magma becomes fluid once more, and rises in the channel, pressure increases again, the fresh magma which has risen from below begins to solidify, and the cycle repeats itself.

Such, briefly put, is the theory of volcanic activity proposed by Prof. Doelter; in his paper it is elaborated in greater detail than can be given here, but there are certain calculations dealing with the question of the depth from which eruptions take place which are of sufficient interest to be quoted. The depth of the primary, or original, source of magma is almost beyond determination; it may be as much as 100 or 200 miles, but is probably less. That of the secondary, or immediate, source is more amenable to determination.

By different lines of reasoning, it is concluded that the immediate source of activity in the case of Vesuvius must have a temperature of about 2300° to 2550° Fahr. (1300° to 1400° C.), and as the lower of these temperatures represents the melting point at a depth of 12½ miles, we get an appropriate idea of the maximum depth from which eruptions take place. It must be remembered that they may actually start from much shallower depths.

Prof. Heilprin's book * is mainly devoted to the consideration of a phenomenon which is not provided for in Prof. Doelter's theory, but is not inconsistent with it. The great spine of Pelée, which was developed after the eruption of 1902, is one of the two interesting, because unexpected, phenomena which attended this outburst of volcanic activity. The beautiful illustrations, with their brief and clearly worded explanations, which exhibit the nature of the phenomenon more clearly than any verbal description could do, will be welcome whatever may be thought of the explanation favoured by the author. It is certainly, as he urges, inconceivable that there should have been a "general and united solidification within the chimney of the volcano over a surface having a diameter of 350 to 500 feet or more, accomplished so rapidly as to prevent all overflow," but we are not aware that this view was ever held. The question at issue is whether the spine was an old solidified core, the relic of an older eruption, or composed of new lava belonging to the last outburst; it is indubitable that the spine, rising to 1000 feet above the crater, must have had a root to support it, as much as the tooth which it so strikingly resembles, and a probable explanation of its origin is that it consisted of solidified lava, still hot enough to be plastic under sufficient pressure, which was squeezed out from below much in the way that leaden rods are made by forcing lead through a small aperture. The explanation is a conceivable one, given sufficient pressure from below—equally required by Prof. Heilprin's theory.

Among the other illustrations are some interesting ones of wine-glasses which have been softened and deformed by the heat and pressure of the ashes brought down by the "black cloud," and attention is drawn to this as a probable explanation of the deformation which has been noticed in some of the glass vessels dug up from the ruins of Pompeii.

R. D. O.

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* 'The Tower of Pelée. New Studies of the Great Volcano of Martinique.' By Angelo Heilprin. Philadelphia and London. 1904. Pp. 62 and 23 plates.

REVIEWS.

AFRICA.

The Kamerun.

'Kamerun und die Deutsche Tsâdsee Eisenbahn.' Von C. Réné, Unter . . . Mitarbeit des Herrn Prof. Dr. F. Wohtmann. Berlin: E. S. Mittler u. Sohn. 1905. *Maps and Illustrations. Price 6s. 6d.*

In this manual the author, a traveller with considerable knowledge of the Mohammedan states of Central Africa, takes summary stock of the most promising of the German colonies in respect of its geography, geology, climate, vegetation and fauna, population, natural waterways, trade, and railway capacities. The work, which is written in a clear, genial style, and animated by an undertone of colonial enthusiasm, is provided with three maps, one of them incorporating hitherto unpublished surveys and a number of illustrations, but has yet to be provided with an index. Geographically the colony is distinguished into four main sections: (1) The southern part, stretching northwards to 4° N. lat. and comprising some 40,000 square miles, consists of hilly woodland rising from the flat coast to over 2000 feet high, but gradually declining towards the east. (2) To the north, again, is the Kamerun highland proper, a plateau-like formation crossed by high mountain ridges and *massifs*, but falling off gently towards the east. Abutting on the Central African highland, this region is the source of numerous rivers flowing to all the cardinal points. It rises in terraces to over 4000 feet high, and the question of its availability for cattle-rearing settlements will come up later on for determination. In any case, it seems to the author in every way well adapted for cotton culture. Its area is roundly calculated at 130,000 square miles. (3) Further north the highland sinks into the Chad lake depression, and of this region Germany claims over 10,000 square miles. (4) In the south-west of the colony there rises by the sea the volcanic *massif* of the Kamerun mountains, which, with its spurs, may cover an area of about 3500 square miles. The mighty Kamerun mountain occupies by itself some 80 square miles. As to the economic resources of the colony, the richly basaltic region of the coast, more particularly about the Kamerun mountains and in Bakossiland, as also in Adamaua, is credited with decided fertility. The coast region is covered with a mighty primeval forest, in places much more than 100 miles broad. The red and yellow earth, too, the product of the weathering of archaic rock, which constitutes the main basis of the colony, is claimed to be much more fruitful than the coffee lands of east Usambara. In the low flat lands of the south and the Bakossi mountains, Prof. Wohltmann finds a vast area of most fertile soil, holding out the best promises to plantations of every kind. In respect of temperature, Duala has a yearly mean of 77·5° Fahr., and in the warmest month (February), 80° Fahr. In Bali the temperature ranges from 63° to 67·5°. In the mountain lands the climate is fairly cool. The rainy season is March to October, whereas December to February is almost rainless. Thunderstorms are frequent. In the coast region the rainfall is heavy, the west and south sides of the Kamerun mountains approximating to the rainiest places of the world. The population, hitherto reckoned at 4 to 5 millions, is by Prof. Wohltmann estimated at 10 to 12 millions at the very least. In the north are towns of large population. Bamum has 60,000 inhabitants; Dikoa, 35,000 to 40,000; Ngaundere is larger than Dikoa. Starting from Rio del Rey on the Nigerian frontier, the railway will skirt the shore south-eastwards to Port Victoria. The next station, Duala, is the chief harbour of Kamerun, a town of 23,300 inhabitants, possessing ample elbow-room, and, in the author's estimation, every qualification for

unlimited commercial development. From Duala two lines are projected: a north-east line to the Chad lake, and an eastern line following the lower and middle course of the Sannaga.

AMERICA.

History of Canadian Discovery.

'The Saint Lawrence Basin, and its Border-lands. Being the Story of their Discovery, Exploration, and Occupation.' By Samuel Edward Dawson, LITT. D., F.R.S.C. *With Illustrations and Maps.* (The Story of Exploration. Vol. 4. Edited by J. Scott Keltie, LL.D., Sec. R.G.S.) Pp. xl., 451. London: Lawrence & Bullen, Ltd. 1905. 8vo. 7*s.* 6*d.*

This admirable history of the river of Canada, dedicated to Sir Wilfrid Laurier, is well worthy of its position in its series. The King's printer at Ottawa has found time, amid the pressure of Parliamentary duties, to give us a volume of scientific history which almost approaches a romance. It is an advantage, too, that only a portion of a continent, and not a whole continent, is here set before us. The first volume in this series, also full of romance, was not quite commensurate in size with the importance of its subject.

In the introductory sketch of the discovery of America, it is interesting to read of the little son of Geoffry Chaucer, for whom his father compiled a treatise on the astrolabe, which also shows that the study of astronomy in its practical application to latitude and longitude was a favourite one among the learned in England in the fourteenth century. To Spain, Portugal, and Italy, however, are due the first steps towards the discovery of America, and the intellectual and the commercial prominence of the Italian people can best be realized when we reflect that a Genoese, Columbus, discovered America for Spain; a Genoese-Venetian, John Cabot, discovered the mainland for England; a Florentine, Juan Verrazano, created a claim for France by his voyage along the northern coasts and Acadia; while the whole Western world was named America after another Florentine, Amerigo Vespucci.

The discovery of the Western world was largely assisted by the island outposts upon the western ocean, such as Fayal, in the Azores, famous for its connection with Martin Behaim. But among these islands on the early charts are many existent only in sailors' fancy, and William Faden's Atlas, published in London as late as 1766, actually gives Magda island and Green island.

The Behaim globe, still preserved in Nuremberg, shows that it was no surprise to the scholars and mariners of Europe when Columbus found land across the western ocean, but the surprise was when the land found proved not to be Cathay. Even in the Royal Commission to Cartier, and in the maps of the French school of cartography, it was thought that on the north Asia was continuous with the northern part of America.

The first discoverer of what is now the Dominion of Canada was John Cabot, of Genoa, who sailed from Bristol, and in 1497 landed upon the shore of one of the eastern provinces of Canada, while in that and the following year he sailed along its Atlantic seaboard, as well as along the outer coasts of Newfoundland. Bristol, the second city in all England, was well to the front in the path of discovery, even before 1497, and it is comforting to our national pride to read that it was an English ship and an English crew which first touched the continent of America, though the moving spirit was an Italian, born in Genoa and trained in Venice.

King Henry VII. cautiously empowered the Cabots to sail "with as many mariners . . . as they will have them . . . *upon their own proper costs and charges*," and his subjects were to give the Cabots "all favour and help . . .

in supplying them with stores and victuals *to be paid for by their own money*." Great as were the results of Cabot's discoveries, his grave is unknown and unhonoured, and after four hundred years of neglect, a small memorial tower has been erected on Brandon hill, at Bristol. Yet Spain, even in the day of her humiliation, could care for the remains of Columbus, while his descendants are still grandees of her once magnificent empire. As concerns the first discovery of the new lands, the claims of Sebastian Cabot, the son of John Cabot, may be left in the formula originated by the able and eccentric Mr. Henry Stevens of Vermont—

"Sebastian Cabot — John Cabot = 0"

The last mention of John Cabot is the note of payment of his pension to Lady Day, 1499, discovered in 1897, in the Westminster Abbey Records, by the late Mr. C. H. Coote, of the Map Department of the British Museum.

In the next reign we find the first letter on record sent to England from America, from John Rut, at the harbour of St. John, to King Henry VIII., and in the thirty-third year of that king we find the first English statute referring to America, on "Newland," or Newfoundland. Dr. Dawson records a quaint expedition, in 1536, of some thirty barristers "of the Innes of Court and of the Chancerie," who sailed for Newfoundland, and all but died of starvation. But they seized a French ship which arrived just as they were casting lots who should be killed, and returned home. The king had to compensate the Frenchmen liberally for the piracy of his learned counsel.

The Portuguese had been equally active in exploration, and by 1534, the date of Jacques Cartier, the whole Atlantic seaboard of the Dominion of Canada had been explored. Cartier sailed from St. Malo on April 20, 1534. His second voyage sailed on May 16, 1535. The original narrative of this voyage, the 'Bref Recit,' was published at Paris in 1545, and the only copy known is in Mr. Thomas Grenville's Library at the British Museum. A new edition, with a translation, is shortly to be issued by Mr. H. P. Biggar, one of the ablest archivists of the Canadian Government. It is strange that the Hakluyt Society has issued no edition of any travels in Canada, though in 1859 they issued a translation of Samuel Champlain's 'Voyage to the West Indies and Mexico, 1599–1602.' Samuel Champlain succeeded Jacques Cartier, and sailed from Honfleur on March 15, 1603. The last half of this interesting volume gives a bright and succinct sketch of the French exploration of Canada and its great rivers, and a vivid picture of the self-devotion of the Jesuit missionaries, ending up with an account of the settlement of M. Menier, whose name, along with some others in the text, has unfortunately been omitted from the index. The reproductions of early maps, and portraits, the illustrations of scenery, and Mr. J. G. Bartholomew's orographical map of the St. Lawrence basin, on a scale of 1 : 5,000,000, leave little to be desired.

B. H. S.

South American Rivers.

'Estudio e Projecto sobre Navegação a Vapor do Rio Negro.' Por Leonidas Norzagaray-Elicechea. London: 1905.

This *brochure* contains much of geographical interest regarding the great valley of the Rio Negro affluent of the Amazon, as well as the country drained by the headwaters of the Orinoco river and its south-western tributaries. The author has travelled extensively in these regions, and his explorations have led him to propose to the Government of the state of Amazonas the navigation by steam of the upper Rio Negro and its branches, and the establishment of a great commercial avenue between Manaos and the Orinoco by way of the isthmus of Pimichin,

as well as by that wonderful waterway, the Casiquiari canal, which connects the Amazon and Orinoco river systems. His plan includes the removal or avoidance of the obstructions existing in the Rio Negro at San Gabriel and Camanaos in the 25-mile stretch of the river. He even proposes to open a commercial *route* from Manaos to Bogotá, and, as a result of his personal explorations, he states that "a natural, open, continuous detritic formation, or macadam, of 900 feet average width and uniform level, separates the Meta and Vichada rivers, and descends from San Martin, on the eastern slope of the cordillera of Sumapaz to the river Orinoco."

Since 1860, a treaty has been in existence between Brazil and Venezuela, which fosters a transit commerce between the two countries; but the obstacles to navigation have prevented the development of any important trade. No doubt, if they could be removed or avoided at a moderate expenditure, the upper valleys of the Orinoco and Rio Negro, which are very rich in indiarubber, might find an outlet *viâ* the river Amazon, and thus avoid the dangerous falls and rapids of the middle Orinoco. The Rio Negro is navigable for light-draft craft the entire year, except at the short stretch of rapids above named.

The production of indiarubber in the Casiquiari district is already considerable, and is stated to be about one hundred tons yearly.

In colonial times the border-land between the Amazon territory of Portugal and that of Spain in the Orinoco valley was held to be of much value by the respective contestants for its possession, and many small forts were built at strategical points. Among others, the fortresses of San Felipe, Marabitana, and St. Gabriel were built between 1754 and 1763, and, on the confines of the Rio Branco branch of the Rio Negro, several points were fortified during the last half of the eighteenth century to also protect the district from advances up the Essequibo river, the portage across the water-divide being very easy, and only a mile long. Nearly all of the above-named forts were abandoned by 1788.

The Casiquiari canal was discovered in 1744 by the Jesuit father, Manuel Roman, and became the ordinary route between the Catholic missions of the Orinco and Rio Negro.

Many writers have called attention to the possibility of connecting the Plata river system with that of the Orinoco by a navigable water route through the heart of the continent; but, so far as the upper Paraguay, the Guaporé, and river Madeira are concerned, it is a scheme impracticable of realization, owing to hundreds of miles of rapids and falls; but a project looking to the removal of the obstacles which exist between the Amazon and upper Orinoco, *viâ* the Rio Negro, and the establishment of a valuable avenue for traffic by steamers to develop the great resources of an immense area of country, seems to be worthy of careful, detailed study by the state of Amazonas.

G. E. C.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Surveying.

'Text-book of Topographical and Geographical Surveying.' By Major C. F. Close, C.M.G., R.E. London: Printed for H.M. Stationery Office by Harrison & Son; sold by Wyman & Sons. 1905. *Price* 3*s.* 6*d.*

Major Close has at last filled a gap in technical literature which has long wanted filling. For years past there has been a slow but very steady advance in English geographical schools, the tendency of which has been to place England more on a level with her continental neighbours in matters relating to the acquisition of map

knowledge of her widespread possessions beyond the seas, than was possible under the restrictions which necessarily distinguish Ordnance Survey methods. No standard work on topography, as applied to continents rather than counties, has previously existed in the English language, unless we make an exception of Mr. Wilson's 'Topographic Surveying,' which is certainly a valuable summary of the principles of the art from the American point of view. Major Close leaves nothing to the imagination, although he wisely confines himself to the strict limits of his subject, declining to enter into the tempting field of geodetic discussion (on which science there is already an ample literature), and dealing only with those practical issues which bear directly on the final attainment of sound topographical maps. For the first time, too, we have all those branches clearly defined, and the relative value of the map results properly co-ordinated with the object they are meant to serve. The place of topography in the wider field of geography is well maintained, and the principle that it is just as scientific to make approximately accurate mapping (so long as it will always fill its own place in the world's geography without error and without distortion) as to labour through all the preliminaries of geodetic arc measurements, and thus be left hopelessly behindhand in the practical results of useful map-making, is clearly intimated. In short, it is a practical work all through—as a text-book should be—and it is to be earnestly hoped that it will form the basis of topographical instruction in all the geographical schools in England.

So full and so complete is the work in the matter of forms, tables, and illustrations, that it would take a long time to refer to all those features of it which deserve special recognition. The illustrations are excellent, and if any criticism can be applied to them it is that they are almost too good. One or two specimens of the very roughest and readiest form of topographical art, as applied by highly trained Indian explorers to districts over which they may have to carry a reconnaissance at the rate of hundreds of square miles per diem, would not have been out of place in a work of this sort.

From the commencement of the book we note that Major Close insists on the importance of a preliminary basis of triangulation, or traverse, for topography, and rightly maintains the advantage of such a basis over any form, or combination of forms, of astronomical observation. His remarks on the preliminary base measurement include a reference to those newer methods which have been introduced by French experts, which render the process of rapid measurement so much more accurate than was formerly possible. It is for this reason, perhaps, that he does not insist forcibly on the necessity for a constant repetition of linear measurements during the extension of the reconnaissance (or "geographical topography"), which was adopted till lately as the best means of compensating error. All the most useful methods of carrying out what we may term irregular triangulation are well explained, but we may, perhaps, note that it has been found in practice *always* necessary to introduce an azimuth value derived from astronomical observation with the computations for interpolating a position by triangulation, whether from three or more points or from two. Whilst Major Close very rightly insists on the uncertainty which attends latitude checks owing to inconstant level deflection, he perhaps depreciates the value of such checks a little too far. The uncertainty must always exist, but in practice it has not been found to invalidate their usefulness to any great extent.

The chapter on the use of subtense instruments for traversing purposes is most useful. It is an essential detail in topographical surveying which is often overlooked. The use of the plane-table is advocated by an expert at the process. One small detail may perhaps be emphasized even further than by the italics which

Major Close gives it. *Pins should never be used* to assist the plane-tabler to align his ruler. It is a slovenly expedient which is too often made use of. I have seen a plane-table that looked like a pin-cushion in a military school lately.

The chapter on "Surveys on Active Service" is altogether good. There is a point about map-reproduction in the field which is perhaps worth more discussion. The sun-printing processes (blue prints and the like) can be made use of with far greater facility than either lithography or zincography. The latter may be superior in their results, but the advantage of illustrating the first despatches after an action by a sketch-map made during its progress, and reproduced with the utmost rapidity, are not to be overlooked. It might very well happen that at the close of an extended action covering 8 or 10 miles of front, the position of every brigade could be indicated to the general commanding by means of a series of sketch-maps made during the course of the action, traced and printed within an hour or two, given that light was available. This would hardly be possible by any other means than sun-printing. On the subject of map projections Major Close is perhaps the best authority in England, and he treats the subject liberally. The story of British mapping might possibly be considered as hardly appropriate to a text-book; but the moral of it is far too important to allow of its omission. That moral is best given in Major Close's own words, "No system of sketching, no combination of sketches, and no compilation of previously unconnected material, whether sketches, isolated surveys, or from plans, will result in a trustworthy topographical map." The grand ruling principle of working from the whole to a part, and not *vice versâ*, is the keynote of the whole book—the golden rule which must surely govern all English surveys in the great future before them.

The subject of astronomy as an adjunct to topography is well and fully illustrated. Due value is given to the various methods of determining longitude, and Major Close gives expression to the opinions of all experienced topographical and geographical surveyors in his summary of this subject. It might be expressed as follows: "Never take an observation for an abstract value of longitude if you can obtain that value differentially by telegraph; never use the telegraph if you can get a differential value by triangulation."

Taking it for all in all, it is the best book on topography that has yet appeared in the English language, and will certainly serve as a standard guide for all the many geographical schools in the country.

T. H. H.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ocean Commerce.

'The Organization of Ocean Commerce.' By J. Russell Smith, PH.D., Instructor in Commerce, University of Pennsylvania, No. 17 of the series in Political Economy and Public Law of the Publications of that university. Philadelphia: 1905.

This is an excellent work, which must prove indispensable to all who are interested in commercial geography. The nature of the work is exactly indicated by its title. The volume develops systematically, with respect to ocean transport, the corollaries that flow from the great facts relating to transport—that commodities are always carried most economically in the largest vehicles, provided only that the vehicles can always be filled; that the cost of carriage is more or less enhanced where goods cannot be conveyed directly to their ultimate destination, but have to undergo one or more handlings and changes in the mode or the means of conveyance; that the loss of time in carriage is serious, especially in the case of certain commodities; and that losses are also involved in uncertainty as to the time of

despatch and arrival of goods. These facts are not geographical. The geographer has to accept them as he accepts a multitude of other facts which are not geographical; but, accepting them, he has to inquire into the geographical conditions that in consequence of them favour or hinder economy of transport; and in applying them to ocean transport, he has to take into account three other great facts—one not geographical, the others at least partly so. The first of these three facts is that ocean carriage is essentially cheaper than any other method of transport. So far as this arises from the circumstances that ocean-carriage is water-carriage, and consequently involves less friction in the movement of a vehicle, this fact is non-geographical; but so far as it arises from the ocean being a great free highway leading in a countless variety of directions, one that allows of the use of vehicles of any dimensions, and one on which a free source of power is more or less available, it is geographical. The second of the three facts referred to is that competition tends to reduce the rate of carriage, and this is, of course, non-geographical. The third is that the getting rid of competition by monopolistic organization is much more difficult in ocean than in land transport, and this is geographical, inasmuch as it is the result of the actual distribution of land and water.

Bearing in mind all these facts, then, what the geographical student of ocean transport has to do is to consider such questions as these. What are the local circumstances that favour the accumulation of a full cargo at one seaport destined for some other seaport, and especially a full cargo for a large vessel, as well as a full return cargo? If the full return cargo is impossible, what are the conditions that favour the shortest voyages without cargo or without full cargo? What are the conditions that favour the regular going and coming of fully laden large fast vessels? And so forth. It is just such questions as these that Dr. Russell Smith considers, and his inquiry enables us to understand why it is that even at a time when steamers are acquiring a larger and larger share of ocean carriage the British seas still swarm with schooners, barques, and other small sailers; why large sailers still carry considerable quantities of heavy bulky commodities, like coal, timber, grain, jute, etc., between distant shores; why a port like Galveston exports goods to thirty or forty times the value of those which it imports (from abroad); why Belfast sends abroad a much greater value of raw cotton than it does of all British and Irish commodities put together, even including ships; why the prices of Cardiff coal in some cases bear little relation to the distance from Cardiff; and a number of other facts of commercial geography which at the first blush may seem surprising.

Dr. Russell Smith's monograph, apart from an introductory chapter on the character and importance of ocean traffic, and a concluding chapter discussing tendencies in commercial organization, is divided into three parts. Part i. deals with traffic, and considers the conditions that favour charter or tramp traffic, that is the carriage of goods according to the demand of the occasion, and line or regular traffic, as well as what is called berth traffic, which is a sort of hybrid between the two, a tramp steamer being advertised to sail on a particular date on a certain route, either unconditionally or on the condition of a stated quantity of traffic being secured for the date announced. In this part the conditions determining freights are also considered. Part ii. deals with routes and shipping, and includes chapters on coal supply and coaling stations, the competition of sailers and steamers, the Government control of shipping and supervision of ocean routes, as well as a very interesting chapter on the probable effects of the Panama canal, in which the author, on the assumption of a toll being fixed on a non-paying basis, gives cogent reasons for taking a more favourable view of the range and amount of traffic likely to pass through that canal than that which is taken by Colonel Church in his paper in

vol. 19 of the *Geographical Journal*. Part iii. is devoted to harbours and port facilities. A map of the world shows ocean trade routes, both sailing and steamer, coaling-stations (distinguishing the leading commercial coaling-stations from those in which 500 tons of coal or more may be obtained) and telegraph connections, as well as the limits of the trade winds in the northern summer and the northern winter, of the prevailing westerly winds, and of the monsoons. These last, it must be confessed, are not easy to understand, and are not in agreement with the usual accounts of the monsoons or the wind directions shown in the maps of the ocean winds in Bartholomew's Atlas of Meteorology.

Dr. Russell Smith does not give many bibliographical references, his work being mainly the result of personal inquiry and observation, not only in America, but in most of the leading ports of Europe. "The chapter upon the handling of freight is, in nearly every paragraph, the result of direct observation."

G. G. C.

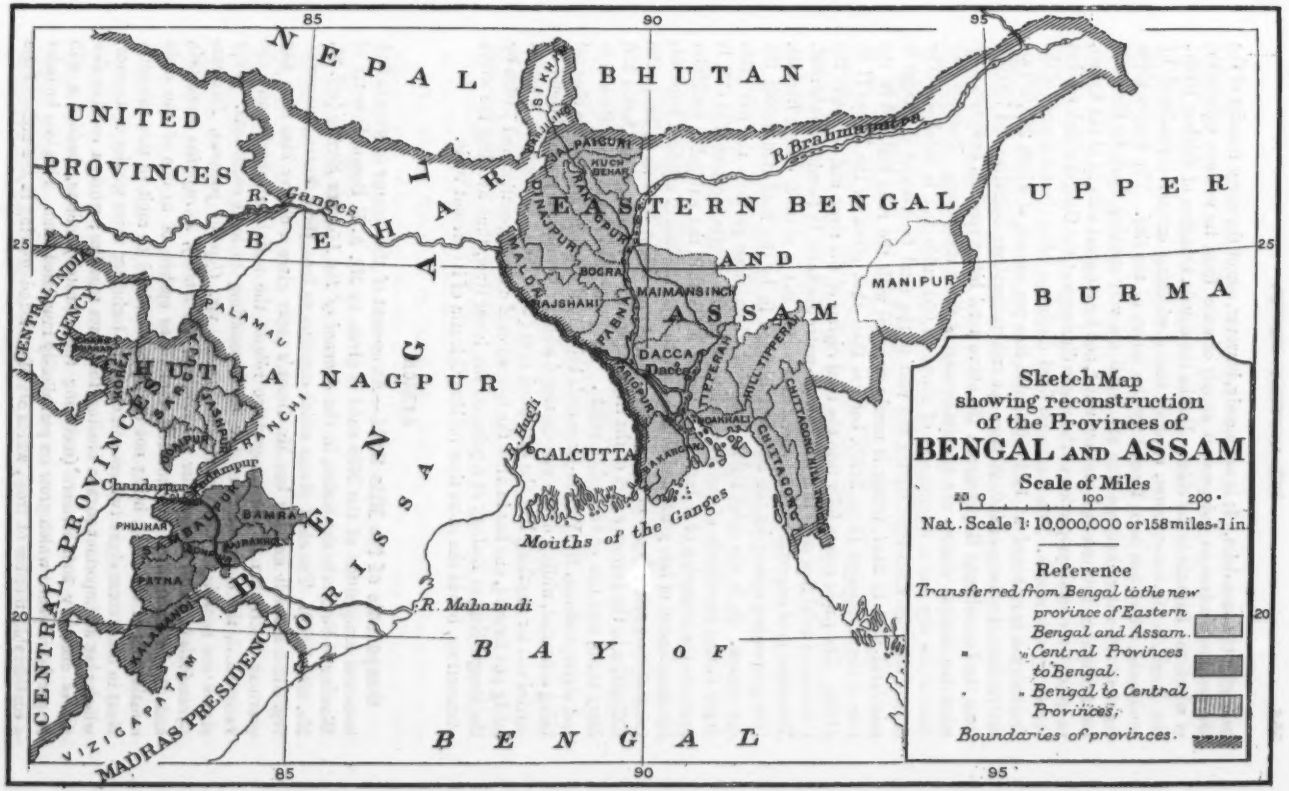
THE MONTHLY RECORD.

ASIA.

Dr. Sven Hedin's New Expedition.—Dr. Sven Hedin has already reached Constantinople *en route* for Persia, where he proposes to thoroughly explore, from a scientific point of view, the salt deserts of Dasht-i-Kavir and Dasht-i-Lut in the eastern part of the country. He hopes afterwards to proceed through Afghanistan to India, and there organize an expedition for the exploration of Central Tibet.

The Bengal-Assam Reconstruction.—The accompanying sketch-map shows the territorial adjustments which have been made for the purpose of relieving the Bengal administration of the undue burden entailed by the vast increase of its population. The details of the arrangement were explained fully in the September number of the *Journal* (p. 330), to which the reader may be referred. It will be seen that the area with the darkest shading in the map is formed by the bulk of the Sambalpur district, together with the five Uriya-speaking states which have been transferred from the Central Provinces of Bengal in deference to the desire of the Uriya-speaking peoples to be united under one administration. The lightly-shaded area to the north, on the other hand, represents the five native states, all with a Hindi-speaking population, which have hitherto been attached to the Chutia Nagpur division, but are now transferred to the Central Provinces. The large area in Eastern Bengal, now united with Assam, includes the whole of the Chittagong, Dacca, and Rajshahi divisions, together with the districts of Malda and the state of Hill Tipperah.

The Hugli River and its Navigation.—In a paper read before the Institute of Civil Engineers in January last, and printed in vol. 160 of the *Proceedings* of that body, Mr. L. F. Vernon-Harcourt supplied a valuable summary of our knowledge of the Hugli and of the changes that have taken place in its channels since accurate surveys have existed. He also outlined the various proposals which have been made for improving the navigation, and put forward suggestions of his own for that object. The writer himself made a careful examination of the river in 1896, and has since made a study of all existing charts, including those issued by the Survey department of the Port of Calcutta commission since 1896. The paper opens with a sketch of the physical characteristics of the Hugli, which, as the writer points out, like the rest of the mouths of the Ganges, presents the somewhat unusual conjunction of being tidal for many miles from the sea, and yet



Sketch Map showing reconstruction of the Provinces of BENGAL AND ASSAM

Scale of Miles

25 0 100 200

Nat. Scale 1: 10,000,000 or 158 miles = 1 in.

Reference

Transferred from Bengal to the new province of Eastern Bengal and Assam.

" Central Provinces to Bengal.

" Bengal to Central Provinces.

Boundaries of provinces.

belonging to a vast delta. It is not merely, however, one of the many mouths of the Ganges, but receives an independent supply of water from its western tributaries, of which the Damuda is the chief. Unlike the deltaic branches of tideless rivers, the Hugli, in its lower course, expands into a widening estuary encumbered by sandbanks, which has been formed by the action of the tide. The figures given for the fresh-water discharge into the Hugli are very striking, both for the enormous difference between high and low water, and for the great volume at the former, in spite of the small proportion of the whole discharge of the Ganges which reaches the sea by this mouth. The maximum flood discharge below the confluence of the Rupnarayan is reckoned at 1,350,000 cubic feet per second, of which 200,000 are derived from the Ganges; 450,000 from the tributaries above Calcutta; and 700,000 from the Damuda and Rupnarayan; the above total being reached, however, only when the various sources are simultaneously at their maximum. Towards the close of the dry season a minimum of about 21,000 cubic feet is reached. The ratio of alluvium discharged during the year to the total fresh-water discharge is calculated at 1 in 2444, which is nearly identical with the ratio assigned in the case of the Mississippi (1 in 2420), but less than that given for the Rhone (1 in 2166). The paper enters fully into the tidal *régime* of the river, and compares the influence of tidal flow with that of the fresh-water discharge in forming its channel. The latter is of importance as an agent in scouring out a channel during freshets, thus preventing silting by the sediment brought in by the flood-tide during the dry season. It is the tidal influx, however, which alone provides the navigable depth during two-thirds of the year, while, with the reverse movement at ebb, it prevents the formation of a bar. The writer holds that the navigable condition has deteriorated of late years, and thinks that, though the idea of artificial improvement of the estuary is out of the question, something might be done to lessen the difficulties in the narrower part of the river, especially at the dangerous James and Mary shoal, and one or two other points. The paper gave rise to some discussion and correspondence, Mr. Vernon-Harcourt's belief in the deterioration of the channel being contested, while a doubt was expressed whether the scheme proposed could be carried out for anything like the estimated sum (£170,000). Among the schemes lately put forward, one has in view the formation of a coaling-station and jetties by the Bengal-Nagpur Railway at a point on the lower river, thus avoiding the worst obstructions, but at the same time robbing Calcutta of its present trade.

AFRICA.

Components of the Nile Sudd.—An account of the manner of growth and botanical composition of the Nile sudd is given by Mr. A. F. Broun, Director of Woods and Forests in the Sudan, in the *Journal of the Linnean Society* (vol. 37, No. 258, 1905). The chief plants which combine to form these floating masses of vegetation are well known; but Mr. Broun's paper gives a clearer idea than any previous description of the comparative *rôle* of the individual species and the variation in the composition of the sudd according to local conditions. Four plants are named as the chief sudd-formers, viz. *Cyperus papyrus*, *Panicum pyramidale* (*om-suf*, or "mother of wool," of the Arabs), *Phragmites communis*, and *Typha australis*; the ambatch, sometimes spoken of as one of the main constituents of the sudd, being not considered entitled to rank in this category. Next in order come eight twiners and climbers, including three species of Ipomea, which play an important part in binding the mass together; while a considerable list of accessory sudd-formers (including the ambatch) follows, besides a still longer list of plants which grow on periodically inundated land. This last includes a considerable number of trees, which are often found growing in the midst of the

sudd, and may have originally started growing on the floating masses. The four primary sudd-formers (especially the *Panicum* and *Phragmites*), and, among the climbers, *Ipomœa reptans*, have tubular rhizomes, which interlace and contribute to the formation of rafts of considerable buoyancy. At the Lake No end of the marshes the fringe of papyrus (which requires a certain depth of water) is continuous for many miles, large stretches of *Typha* occurring, however, in the shallower water behind this hedge. Towards the south the papyrus is more and more replaced by the tall *Phragmites* reed; while the *Panicum*, which has the faculty of growing in both shallower and deeper water than the papyrus, not only occupies ground periodically uncovered, but also forms an outer fringe in the bed of the channel. Mr. Broun considers that the whole extent of the swamps once formed a lake which has gradually silted up from the south. In course of ages the whole would, no doubt, become firm land without the intervention of man, though the interests of the country demand that the process should be hastened.

Exploration in the Kamerun.—A tract in the interior of the Kamerun—at no very great distance, indeed, from the coast—which has hitherto been virtually unknown, is that stretching north-east from the Manenguba range, a line of hills 5° N. which forms the northern watershed of some of the streams entering the Kamerun estuary. It has lately been explored and mapped by a military expedition sent to this district for punitive purposes under Colonel Müller (*Deutsches Kolonialblatt*, August 15, 1905). The exact route followed cannot be traced on any existing map, but Colonel Müller gives some general notes on the nature of the country and its inhabitants, both of which he and the officers under him studied in some detail. The country traversed does not form a single geographical unit, the foothills of the Manenguba range being separated from the interior plateau by a broad depression drained by the Nka or Nkam, shown as a tributary of the Vuri on the best existing maps. The range falls gradually to this low ground, but the ascent to the plateau is steep. The population is divided up into small sections without cohesion, but trade is fairly active. The people have shown no great willingness to submit to European influence, until convinced by experience of the futility of resistance. The country is generally well cultivated, and in places the close proximity of the farms gave it quite a European aspect. Rice might be cultivated on the lower grounds, rubber on the plateau, and cotton on the steppes of the Bamum country.

The Water Question in the South African Steppes.—Inasmuch as the whole future of many of the more arid parts of Africa (to say nothing of other continents) is bound up with the question of water-supply, all researches dealing with this subject from a scientific point of view are of great importance. Such an examination of the question, as concerned with the underground water and its evaporation, is undertaken by F. Gessert in the *Zeitschrift für Kolonialpolitik*, etc., vol. 7, part 4, 1905. The writer discusses first the mechanism of the evaporation of ground-water, as brought about by the circulation of air within the ground, and afterwards treats of the effects of such evaporation and the various agencies by which it is increased or diminished. The subject is a somewhat obscure one, and, as the writer insists, much research is needed before all the problems connected with it can be solved. His conclusions may not all be accepted without controversy, but his paper is valuable as showing the practical importance of the subject and the need of scientific training on the part of those who take in hand the amelioration of arid regions. Herr Gessert points out the important influence exercised by the evaporation of ground-water on the general meteorological conditions of a country, and finds that an increase in its amount has, as its result, a diminution of rainfall. In general its result must therefore be

detrimental, though instances are given in which it may be advisable to stimulate the process, for the sake of cultivation, either by pulverizing the surface soil or by raising the level of the ground water. It is necessary, however, to guard against rendering the surface soil too salt by the latter means, though in certain cases the salt soil is beneficial from its greater capillarity, and can be utilized for the cultivation of salt-loving plants. The principal cause of the increase of evaporation now in progress is the destruction of vegetation, and much might be done to check it by scientific afforestation, the date-palm being eminently suitable for planting in the whole southern part of German South-West Africa. The ways in which cultivation by the aid of irrigation may check the evaporation of ground-water are stated to be the following: The moist surface soil presents greater obstacles to the penetration of air than dry soil would. Moreover, any air which does penetrate takes up moisture in the process, and can therefore exercise a smaller drying effect on the lower layers. The damp surface also prevents the great fall of temperature which takes place by radiation from dry soil. The growth of vegetation without artificial irrigation (which can often be dispensed with when a start is once made) has a similar effect. The general conclusions are as follows: The loss by evaporation of ground-water is far greater than by the flow of water above or below ground, and ground-water is a much more valuable source of supply than river-water conserved in reservoirs. An improvement in climate can be brought about by bringing the evaporation process from the lower levels to the surface, though this must be done on a very large scale before an increase of rainfall can result.

The Masai Uplands. Erratum.—The name of the author of the letter on this subject in the October *Journal*, p. 466, is wrongly spelled in the text and the map; it should be *Meinertzhagen*.

AMERICA.

Mammoth Remains and Ice-sheets in Alaska.—An expedition was despatched to Alaska in 1904, under the auspices of the Smithsonian Institution, for the purpose of investigating the remains of the mammoth and other large animals of former times, which have been long known to exist in that country under somewhat similar conditions to those of the Siberian tundras. The investigation was placed in the hands of Mr. A. G. Maddren, who has described his search and its results in vol. 49 of the *Smithsonian Miscellaneous Collections* (Washington, 1905). The district selected for the search was that of the Porcupine river, the great northern tributary of the Yukon, on a tributary of which—the Old Crow river—many indications of the existence of such remains in large numbers were discovered, though a shortage of supplies unfortunately rendered it necessary to return before any place of primary entombment of the animals had been reached. The evidence obtained was, however, sufficient to allow the conclusion that an extensive deposit of large Pleistocene mammal remains—represented principally by mammoth, bison, and horse—does exist on the headwaters of the Old Crow river, which enters the Porcupine from the north-west some 60 miles above the Hudson Bay Company's former post at New Rampart house. Mr. Maddren made a careful study of the Quarternary deposits of this region, especially the Pleistocene silts which occupy a large part of the surface, and in association with which the remains appear to occur. He also paid much attention to the accumulations of land-ice, which here, as in Siberia, occur in conjunction with the Pleistocene deposits. His report, in which his views on these points are fully discussed, is therefore an important contribution to the much-vexed question of the recent geological history of these northern regions, both of Asia and America, the general

conditions showing a striking similarity in both. In certain directions he is distinctly at variance with the views generally held by geologists, and it is interesting to note that the well-known views of Sir H. Howorth as to the past climate of these regions seem to him fully borne out by the facts observed. He maintains that there are no facts to support the contention that the climate of the Arctic and sub-Arctic Regions has ever been colder than it is now. The Pleistocene deposits of Northern Alaska show no trace of glacial action, except in so far as the material was probably derived from the streams issuing from the great glaciers of the mountain area to the south. The observed deposits of land-ice *overlie* the Pleistocene silts, and belong to the Recent period, in which the comparatively favourable climatic conditions which prevailed during the Pleistocene have suffered a progressive deterioration. The principal ice-sheets are undoubtedly of lacustrine origin, and it is not permissible to conclude, as has been done in the case of the Siberian ice-deposits, that any such sheets are undoubtedly derived from accumulations of snow. Mr. Maddren believes that most of the large mammals in question became extinct with the close of the Pleistocene, owing to the deterioration of the climate. While all the remains so far discovered in Alaska come under the category of *secondary* depositions, the state of preservation of the bones indicates that they have not been carried far, and it is suggested that more complete remains are most probably to be met with on the shores of the Pleistocene lakes, from which the bones hitherto collected appear to have been drifted by ice.

The Kluane District, Yukon Territory.—The summary report for 1904 of the Canadian Geological Survey contains a report by Mr. R. G. McConnell on the Kluane district, lying along the north-east border of the St. Elias range in the south-west part of the Yukon territory. Until about six years ago the country on this side of the St. Elias range was practically unknown, and it is only since the presence of gold on some of its streams was reported in 1903 that attention has been directed to it. As elsewhere, the great range is here exceedingly rugged. Viewed from the hills on the north it presents a complex of sharp, broken, crest-lines, irregular in direction and rising in places into bold rocky prominences, some exceeding 10,000 feet in height. The small streams which drain the northern slopes occupy deep narrow valleys, but the larger streams have wide valleys which extend back into the range for many miles. The central part of the range is covered by almost continuous snowfields, and the largest glacier, the Kaskawulsh, has a length of over 20 miles. Two large rivers issue from it, flowing respectively to the Yukon and to the Pacific. The former (Slims river) enters Kluane lake, which is drained by Kluane river to the White river, the recipient of all the drainage flowing northward from the range. The latter (the Kaskawulsh) joins the Dezadeash river, the combined stream passing through the mountains to the ocean as the Alsek. The country north and east of the range is characterized by broad interlocking valleys, separating groups of mountains, some of which have heights of 5000–7000 feet. The valleys (pre-glacial) are much older than the present drainage system, and the rivers do not fit them. An important topographic feature is the great Shakwak valley, which extends in a longitudinal direction, and is occupied by a number of separate rivers and lakes, including the Kluane. The Alsek river has twice been dammed in comparatively recent times, probably by the extension of glaciers across its valley, and formed lakes of which the beaches are still to be seen. The white spruce is the most important tree of this district. The report describes the geology in detail, two distinct provinces being distinguishable—that of the St. Elias range (mostly Upper Palæozoic), and that of the flanking ranges to the north, formed principally of quartz-mica schists, probably of Cambrian age.

The Zuñi Salt Lake.—This is a small lake occupying a striking depression in the gently sloping floor of the Carrizo valley, New Mexico, from which the Zuñi Indians have furnished themselves with salt for many centuries. It has once or twice been described by geologists, but no certain solution of its mode of origin has yet been forthcoming. The latest discussion of the problem is in a note by Mr. N. H. Barton, of the United States Geological Survey, in the *Journal of Geology* for April and May, 1905, which is illustrated by a map, sections, and photographs. The plain in which the depression occurs is composed of Cretaceous sandstones, in part overlain by lava-flows, while round the margin there is a widespread mantle of fragmental material, mostly volcanic. The walls of the depression (which measures about a mile across) are about 150 feet high, and the bottom is flat and in part occupied by the lake, in part by mud flats. From its centre two volcanic cones rise, one with a deep crater occupied by a pool, which stands at the same level as the main lake, but, though very salt, is less so than the latter. In spite of the abundant traces of volcanic activity in the neighbourhood, the depression itself is not a crater, though it seems probable that its origin is connected with volcanic phenomena. The most plausible explanation seems to be that, after the ejection of the lava-sheet which covers the plain, there was a great ejection of hot water, which dissolved a thick mass of salt, and spread over the surface a large quantity of *scoriæ* and rock fragments, the space thus left being filled up by subsidence over the area now occupied by the depression.

The Plateaus of Tropical America.—In the August number of the American Geographical Society's *Bulletin*, Dr. J. Russell Smith discusses the economic importance of the plateaus of Central and South America, showing the striking contrast which exists between these areas and the rest of the world as regards the altitudinal grouping of population. While in Europe, Asia, and North America it is on the fertile plains and in the river valleys that all the great aggregations of population are met with, in Central and South America the comparatively infertile plateaus form the home of the bulk of the inhabitants. Hardly any of the State capitals are at the same time ports, but the larger number lie on the interior table-lands at a distance from the sea, communication with which is often a matter of difficulty and danger. It is, of course, necessary that they should possess outlets to the ocean for the disposal of their products, and thus in almost every case we find a port on the coast associated with a seat of government and industry in the interior. The population of these ports bears, however, but a small proportion to that of the interior cities. The unnatural character of this grouping is emphasized by a consideration of the paucity of the plateau-products compared with those of the lowlands. The reason is, of course, the unhealthiness of the low-lying areas, but Dr. Smith does not admit that this will necessitate the indefinite continuance of the abnormal state of things above described. He looks to the recent great advance in the knowledge of tropical disease to permit in time the adequate settlement and development of the tropical American lowlands, and holds that this will bring about transformations in world-trade of a magnitude witnessed but once before in the history of the world—at the time of the settlement and development of the Mississippi valley. The result will be a virtual re-discovery of the New World during the present century.

POLAR REGIONS.

Schemes for Polar Exploration.—Among the tracts within the Arctic circle that have not yet been traversed by any expedition, the most interesting from the explorer's point of view is probably that lying between the American Arctic archipelago and the New Siberia islands north of Asia. Even if the

currently accepted view (based on Nansen's discoveries) of a deep polar basin occupying the greater part of the still unknown area be correct, it is by no means impossible that some yet undiscovered land-masses of limited extent may exist on the outer margin of this basin. Rumours of land to the north of Bering strait have gained currency from time to time, and to solve the question would be a good piece of geographical work. Two young aspirants for geographical honours have already set themselves this task. Mr. A. H. Harrison has started on an expedition to the waters of Arctic America by way of the Mackenzie river, bearing practically the whole cost himself, though he has received the loan of instruments from our Society, as well as some of the equipment of the recent Antarctic Expedition. On the other hand, a young Dane, Mr. Einar Mikkelsen, who has had considerable experience of Arctic travel as a member of the Amdrup expedition of 1900 and the Baldwin-Ziegler expedition of 1901–2, proposes to start for the same region as soon as sufficient funds can be collected. His idea is to travel by land to the mouth of the Mackenzie, and thence make his way, by the help of the Government schooner stationed at Cape Bathurst, to winter quarters on the south-west point of Banks land. In the spring of 1907 he hopes to set out from a depôt previously established at Prince Alfred cape, on a sledge journey of exploration to the north-west, taking numerous soundings, and examining any land that may be discovered. Another interesting task awaiting execution is the survey of the east Greenland coast between the point recently reached by the Duke of Orleans and that reached by Peary from the opposite coast. This Mr. Mylius Erichsen, whose recent expedition to the opposite site of Greenland has frequently been alluded to in the *Journal*, proposes to attempt, while paying attention also to various departments of scientific research, as well as to the artistic representation of the scenes to be visited. Lastly, a more ambitious scheme was put forward at the recent International Economic Congress at Mons, the proposal being to establish an "International Association for the Study of the Polar Regions," under whose auspices the remaining problems of polar geography might be solved. The scheme, which originated in Belgium, appears still to be somewhat in the air, and few of the leaders of polar discovery have yet given it their support.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Indian Ocean Expedition.—A letter from Mr. Stanley Gardiner is printed in *Nature* for October 6, giving an account of the scientific work done by the *Sealark* down to the arrival at Mauritius on August 5. This marked the completion of the work in and around the Chagos archipelago, which had been both oceanographical and biological, the former carried out mainly by Commander Somerville and his officers, often under great difficulties. It included both surveys by camping-parties and deep soundings from the ship, with observations on the tides, currents, temperatures, etc. All operations had been hampered by the unexpectedly bad weather experienced, the heavy seas being explained as partly due to the comparatively shallow waters of the Chagos archipelago, partly to the current, which set in an easterly direction, against the wind, during the whole time the party were in the group. The results of the soundings show that the archipelago is closely surrounded, both to the north and west, by the 2000-fathom line, and that there is at the present day no trace in the topography of the Indian ocean of any former connection of the group with either the Maldives or the banks on the Seychelles-Mauritius line. It appears to stand by itself, being built up on a plateau rising to a depth of 800 fathoms in an ocean of an average depth of 2300. The numerous lines of soundings run between the individual banks and shoals have given depths

of 400 to 800 fathoms. The archipelago consists, broadly speaking, of the Salomon, Peros Banhos, and Blenheim atolls in the north; the Great Chagos bank in the centre; and the Diego Garcia and Egmont atolls in the south; besides submerged banks in the north and south. Especial attention was given to the survey of Salomon atoll, for the sake of affording a comparison with Powell's chart of 1837; but the result showed that the latter was too carelessly made for any close comparison to be possible. The new observations show that the atoll rises, in the last 400 fathoms, by similar slopes to those of Funafuti, though it is a much simpler atoll, having only one passage, and more than half the reef being crowned by land. The present reef is extending outwards on every side on its own talus, and in this case, at least, the steep external slope is simply that at which the *débris* come to rest in the water. It was everywhere extremely barren, and the appearance of the dredges from below 250 fathoms gave the idea of bare rock with a little muddy sand. It seems impossible that any upward growth is in progress between the banks, while a considerable current is probably felt even at 500 fathoms. The reefs of the Chagos are in no way peculiar save in their extraordinary paucity of animal life (which gives the marine fauna the character rather of the temperate than of the tropical zone), though this is compensated for by the enormous quantity of nullipores, the seaward edges being practically formed by their growths. The bottoms of the lagoons are bare rock, hard sand, or mud, with shoals arising precipitously here and there. Diego Garcia lagoon (almost entirely surrounded by land) has perhaps the most varied fauna, and this atoll alone gives evidence of enlarging in every direction. It shows signs of a recent elevation of a few feet. The land fauna is largely dependent on the flora, and this (which originally included a forest of large trees) has been in great measure destroyed to allow of the planting of coconuts. About 140 species of plants (probably only half of them indigenous) were collected. Of mammals there are only rats and mice. Among the more numerous birds, noddies, frigates, and terns were breeding in enormous numbers on certain islands, though it was mid-winter. The next cruise was to be largely a dredging one towards the Seychelles.

Relations between the Floras of Africa and South America.—Prof. Engler has approached the much-debated question of a former land-connection between Africa and South America from the point of view of the affinities between the existing floras of the two continents (*Sitzungsberichte* K. Preuss. Akad. Wissenschaften, 1895, parts vi. and vii.). Although, perhaps, the majority of geologists now believe in the existence of such a connection in Jurassic times, the fact is by no means universally admitted, so that corroborative testimony from an independent standpoint is of much value, and in the present case its force is increased by the fact that Prof. Engler was once inclined to discredit the idea, but has now been led, by careful study of the plants of the two areas, to consider a former land-connection probable. The paper first discusses the conclusions to be drawn in general from the existence of allied families, sub-families, etc., in widely separated regions, especially in the case of plants which afford no special facilities for dispersal. The author lays stress on the influence of external conditions on the development of plant-forms, and the resulting impossibility of allied members of a group having been developed independently from a primitive type; the conclusion being that affinities between existing forms do really imply a close association (in space) between earlier representatives of the family. Prof. Engler then examines in detail the principal species which exist in both the continents in question side by side with endemic forms, dividing them into twelve categories, according to their life-conditions and means of wide dispersal. He finds that while for nine of the groups the presence of the common forms in the two continents could be

explained by transport under existing conditions, in the case of the remaining three this is in the highest degree improbable. In these groups there are a striking number of corresponding (rather than identical) species or genera, which seem to demand the existence—at a time when the angiosperms had already reached an advanced stage of development—of a connection between Madagascar, Africa, and South America, either continental or at least in the form of a chain of large islands, more especially as many of the forms are totally wanting in tropical Asia. It is a striking fact that a preponderance of the common forms belong to formations (such as that of the moist forests) members of which are least of all likely to obtain a footing as new-comers, while another noteworthy point is the presence both of steppe and forest plants, for the simultaneous migration of which only lands of considerable extent would afford facilities. The Jurassic connection supposed by geologists would explain a still greater affinity than exists, had the angiosperms reached a sufficient development at that time. It has to be considered whether the supposed connection may not have been maintained through Cretaceous or even Eocene times, in the former of which, as has been shown by recent research, angiosperms were already represented in considerable numbers.

Botanical Geography at the International Botanical Congress in Vienna.—At the first scientific sitting of the Congress on June 13 last, several addresses were delivered on the subject of the development, since the Tertiary age, of the flora of Europe. Prof. Penck discussed its geographical bases. The development since the Tertiary age fell under the influence of the ice age, the climatic conditions of which had only in quite recent times been so far investigated as to supply some measure of evidence respecting the altitudinal position of the snow-limit of that period. Thence conclusions might be drawn regarding the tree-limit, which in the coast region ran at a level at least 2000 feet, and in the interior of the continents over 5000 feet, lower. These conclusions implied that during the ice age mid-Europe stood above the forest limit, and consequently that the domain between the great northern and the Alpine glaciation belonged, as to its flora, to the Alpine and tundra region. As much might be said of the bordering domain of Western Europe. In Eastern Europe the snow-limit stood considerably higher than in mid-Europe, but dry winds must have prevailed here during the ice age, giving rise to steppe-like features. Possibly a part of the Eastern European loess was the dust of these steppes. The forest land of Europe during the ice age occupied the north Mediterranean region where western winds prevailed. The ice age consisted of at least four glacial periods of the type indicated. During their sway the glacier-covered regions were, with the exception of the scanty vegetation on the moraines, devoid of plant life. Successively buried under ice, this domain must always have been freshly occupied by plants during the inter-glacial periods. Our knowledge of these inter-glacial plant formations was still very slight. Northern Germany and France, however, were forest lands, and in the Alps the forest reached higher than it does at the present day. South-Eastern Europe appeared, however, to have been steppe-land during these periods. Of the inter-glacial flora of the north and the south of our part of the globe we know nothing. There was, however, a remarkable similarity between the inter-glacial Alpine flora and that of to-day, especially in view of the established fact that during the last glacial periods it was virtually driven out of the Alps.—Prof. Engler then dealt with the main features of the development of the flora of Europe since the Tertiary age. In no other land of Europe were so many floral regions conjoined as in Austria-Hungary, where nearly all the European floral domains met together. It was, accordingly, no accident that an Austrian, Franz Unger, was the first to point out with certainty that the distribution of plants was to be explained, not from the present

climatic conditions, but as the result of processes of bygone ages. Primitive types of plants still existing in sub-tropical regions were, in fact, found as early as in the Tertiary age. In Greenland and Norway, on the other hand, there were pines, cypresses, and Scotch firs that to-day had their habitat in Eastern Asia. After the ice-age the tree flora prevalent in our time was developed anew. The fig, the laurel, and the vine were perhaps introduced into Europe by man. Through cattle-rearing and agriculture man had, by industrial works and by railways, laid a destructive hand on the vegetable vestment of the Earth, and the regret which this action called forth could only be allayed if, in accordance with the precedent setting apart the National Park in America, inviolable reserves were also set apart in Europe, and in larger measure than had yet been witnessed, as a sanctuary for existing and traditional plant formations.—Dr. Gunnar Andersson spoke of the "Floral Development of Scandinavian Lands." Here the period of development was naturally shorter than in the Alps. Five periods were to be distinguished: those successively of the Arctic-Alpine flora, birch forests, coniferous forests pure and simple, oak forests, pine and beech forests, as also the period of propagation of cultural plants at the hands of man who, be it noted, had now been settled in southern Scandinavia some 10,000 years.—Lastly, Herr C. A. Weber treated of the "History of the Development of the Flora of the North German Lowland." From the Oligocene period it was covered by the sea, whence it emerged only during the later Pliocene period. The earliest vegetation of this latter time was marked by the appearance of the vine in the West. At a later stage of this pre-glacial period there appeared marsh lands of alder trees. Later followed an Alpine vegetation characterized by a variety of the Armorica pine and the mountain pine. This vegetation gave place to a high northern tundra, which at last got buried under advancing land-ice. In the same way the vegetations of the inter-glacial periods were completely extinguished, one after the other, by the ever-advancing ice-masses. During the inter-glacial periods there stood extensive pine forests; at their beginning and end the Scotch fir prevailed. During the melting of the glacier-masses of the last Glacial period the region was occupied at first by a northern Alpine flora, marked by polar, willow and Dryas. On this followed at long intervals the Scotch fir, the oak, and lastly the red beech. The pine did not immigrate into the western parts of the lowland till towards the end of the oak age. The beech appeared after the post-glacial sinking of the land which took place in the region of the Baltic and North Sea. The single drier period in the post-glacial age of north Germany, as yet demonstrated, was not so dry as to then impose on the land steppe characteristics. There possibly took place, nevertheless, at that period an immigration of such steppe plants as may still at this day be found here and there.

Observations on the Gulf Stream.—An interesting study, in detail, of the data supplied by ships' observations in regard to the rate of flow of the Gulf Stream has been carried out in the *Annalen der Hydrographie* for the present year (vol. 33, part vii.). The study is based on the observations of drift during the passage across the Atlantic made by the captains of German ships during the period between May 10 and June 10 of last year, and though fuller results might have been obtained had the number of observations been greater, these are sufficient to give a good general idea of the behaviour of the Gulf Stream water in its passage across the Atlantic from its exit from the Gulf of Mexico. The drifts observed are plotted on a series of charts dealing in succession with a series of short periods, and with the whole period taken together, somewhat after the fashion of the synoptic weather-charts of the North Atlantic, the amount of drift being shown graphically by arrows of varying size. The principal results of the inquiry are summarized

thus. As compared with the mean rate of flow, the observed rates, proceeding from west to east, were alternately too small and too great. The decrease in the rate in an easterly direction did not take place regularly, but after falling off for a space the rate again showed an increase. Irregularities were also observed in the manner in which the current died out; in the position in latitude of the central stream; in the rate at given positions, etc. As a rule, a westerly counter-current was observable to the north and south of the main current, sometimes even exceeding this in speed. The influence of fresh or strong winds was observable even in the case of the strongest flow, both in the direction of acceleration and of retardation. Lastly, no unusual acceleration over the whole area, such as had been reported during the period in question, really took place, in spite of the evidence of strong drifts in individual cases. These sometimes reached as much as 70 nautical miles in twenty-four hours between 75° and 50° E., while in the neighbourhood of the Florida coast the highest figure was 86 miles in the same period.

The Accordance of Alpine Summit Levels.—It has long been remarked that even in the case of intensely folded mountain ranges, a certain degree of accordance in the altitudes attained by the principal summits is observable, though no universally accepted explanation of the fact has been arrived at. The subject is discussed with much acumen in a paper by Dr. R. A. Daly in the *Journal of Geology* for February and March, 1905 (vol. 13, No. 2). Dr. Daly points out that the possible explanations of the fact are of two radically different types, the one set regarding it as the result of inheritance from a former stage in the cycle of evolution, the other as due to spontaneous development in the present environment. Of the former group of hypotheses, that which has hitherto met with most favour in America is the well-known peneplain theory, which no doubt appeals to many from the tempting analogy it offers with the accordance in the case of a dissected plain underlain by rocks of horizontal structure. But, however acceptable it may be in certain cases, this theory has the disadvantage, which places it in marked contrast to all other possible explanations, that it demands at least two cycles of erosion in the history of the mountain chain, differing completely in the nature of the processes involved. The internal structure and original relief is considered the result of intense folding and thrusting, while the movements following on the establishment of the peneplain must be of the nature of broad, relatively gentle warps. The alternative hypotheses have also in their favour that they are not mutually destructive, and thus acquire a certain cumulative force. The observed accordance may be explained, apart from the peneplain theory, as the result of isostatic adjustment during the early history of the range, the existence at any time of summits towering far above their fellows being rendered improbable by the consideration that few rocks could withstand the enormous pressure involved. An early accordance may also have come about through differential erosion, which would always act most forcibly on the highest summits. Various agencies, too, might develop such an accordance during the later history of the range. Isostatic adjustment might again play its part, metamorphism and intrusion might work in the same direction, while important effects might result from the cutting back of glacial cirques; the greater rapidity of erosion above than below the tree-line; and from the tendency which has been observed towards the equal spacing of rivers and the resulting even gradation of intervening ridges. Dr. Daly points out the importance of making a correct choice between the rival theories in view of the widely different ideas respecting the past history of mountain ranges which they involve. He has certainly shown the need for caution in accepting the peneplain theory as the only one capable of explaining the facts.

GENERAL.

Geography at Cambridge.—We have received the regulations and list of lectures for the academical year just beginning, issued by the Board of Geographical Studies at Cambridge. The regulations appear to have suffered no change since their first introduction early in the present year, and we may therefore refer for further details to our note on the subject in the *Journal* for April last (p. 464). The first examinations held under the new regulations took place in the Easter term, and the papers set both in that for the ordinary B.A. degree and in that for the Diploma in Geography are printed in full. They are well calculated to test the extent to which the principles and educative influence of the subject have been assimilated by the candidates, though the boundary-lines between the subjects of the separate papers appear somewhat indefinite. From the questions asked it is not clear what distinction is drawn between "Ethnology" and "Anthropo-geography," while the differentiation between "Regional geography," "Physical geography," and "Geomorphology" on the one hand, and between "Regional geography" and "Political geography" on the other, seems hardly so clear as it might be.

The Royal Scottish Geographical Society.—It is announced that the Livingstone gold medal of this society has been conferred on Sir Archibald Geikie, while silver medals have been awarded to Mr. R. Mossmann, of the Scottish Antarctic Expedition, Major Ryder, and Major Gibbons. The council of the society has appointed as its secretary Major Lachlan Forbes, D.S.O., late 7th Fusiliers. After the retirement of Lieut. Shackleton, early in the past summer, Major Lindsay Forbes had received the appointment, but has been obliged to retire owing to ill health. Major Lachlan Forbes is the son of General Sir John Forbes, G.C.B., and has seen a good deal of active service, having taken part in Lord Roberts's famous march to Kandahar, as well as in the late Boer war.

The Fifteenth Congress of Americanists will take place next year at Quebec, between the 10th and 15th of September. As usual, the subjects to be discussed will include the native races and archæology of America, together with the history of its discovery and occupation by white men. Membership is obtained on payment of three dollars, while associates (who take no part in the deliberations of the Congress, and do not receive its publications, though having the right to be present at all the general meetings), are admitted on payment of one dollar. The names of intending members or associates should be sent in to Dr. N. E. Dionne, Librarian to the Legislative Assembly, Quebec.

OBITUARY.

Pierre Savorgnan de Brazza.

Count Pierre François Camille Savorgnan de Brazza, by whose death, as truly declared by the Minister of the Colonies, "France loses one of her best and most renowned servants," was born on January 26, 1852, at Rome. He spent his youth in his native town. When thirteen years of age he was placed in a Jesuit college at Paris. In 1868 he entered the Naval Academy at Brest, and in 1870 obtained a commission in the French navy. In 1872 he was appointed one of the orderly officers of Admiral Le Couriault Du Quillot, who commanded the French squadron of the Southern Atlantic. His ship, in 1874, was at Libreville, on the Gabon, when Alfred Marche and the Marquis de Compiègne returned from an exploration

of the lower Ogowe. Attention to the importance of this river had first been directed by Paul du Chaillu, its lower course had subsequently been explored by R. B. N. Walker and others, and de Brazza actually conceived the idea that it might eventually turn out to be the lower course of the Lualaba, recently explored by Livingstone, and thus open up a navigable highway into the very centre of tropical Africa. His proposals to head an expedition for the exploration of that river were sanctioned by the French Government, and on October 20, 1875, he was back at the Gabon, accompanied by Dr. Noel Ballay and Alfred Marche. The results of this expedition turned out disappointing. The Ogowe was traced to its navigable head at the Pubara falls (reached by Dr. Ballay in July, 1877); but an attempt to descend the Alima, a river flowing eastward, and supposed to lead to a large lake, was frustrated by the hostile attitude of the Bafuru; and an attempt to penetrate to the north was stopped at Okanga, a short distance beyond the upper Likona. In November, 1878, de Brazza was back at the coast, and learnt that during his absence Mr. H. M. Stanley had followed the course of the Lualaba-Congo down to its mouth, which he had reached in August, 1877. And when it became known to him that Stanley had entered the service of the King of the Belgians, and was actually engaged in taking up steamers past the cataracts of the lower Congo to Stanley pool, he proposed to the French Government to anticipate the action of the Belgians by planting the French flag at Stanley pool and along the upper river. His suggestion was adopted; £5000 were granted by Government towards his enterprise. He left France on December 27, 1879, founded a station, Franceville, on the upper Ogowe, in June, 1880; hastened down the Lefini to the Congo, and made a treaty with Makoko, the chief of the Bateke; and on September 7, 1880, arrived at Stanley pool. Having installed a Senegalese sergeant, Malamine, as guardian of an improvised station, which subsequently became known as Brazzaville, he took the route down the Congo, met Stanley at Isangili on November 7, and then hastened back to the Gabon, where he arrived on December 15. Returning to the interior, de Brazza founded a station on the upper Alima, and then turned westward, and, crossing the basin of the Niadi (Kwilu), reached Landana on the coast on April 17, 1882. His hope that the Kwilu would afford easier access to Stanley pool than a route through the cataract region has not been fulfilled, but politically he had secured for France, not only the right bank of the Congo above Stanley pool as far as 17° E., but also the basin of the Kwilu (convention of February 5, 1885).

After having recruited his health, de Brazza left France once more on March 21, 1883. He had been appointed Commissioner of the Congo Territory, and been granted £5000 towards the realization of his scheme. Arrived at Libreville on April 22, and having organized his expeditionary corps at Lambarene, he left for the interior in June, 1883, and reached the Congo by way of the Ogowe and the Alima, upon which a small steamer had been launched by Dr. Ballay. At the end of April he was at Brazzaville, and, having installed M. de Chavannes at that post, was back at the coast on December 1, 1884. In the mean time he had despatched one of his officers, M. A. Dolisie, with orders to establish himself on the Ubangi, which had but recently been navigated by Mr. Grenfell, and which he pretended to believe was identical with the Likona, or Nkunja, discovered by him in 1878. He was about to lead an expedition to that river when orders reached him, on July 15, 1885, to return to France. A year afterwards, on June 29, 1886, he was, however, reappointed Commissioner-General of the French Congo, and in February he was once more back on African soil. He held this responsible office up till January, 1898, when he was relieved of his functions and awarded, two years afterwards, a pension of £400, to be continued, on a reduced

scale, to his widow. The work of geographical exploration was carried on most actively during de Brazza's tenure of office. Careful surveys were made in the basin of the Kwilu by Cornille, Gondard, and Leon Jacob, with a view to the construction of a railway; Giacomo, or Jacques, a younger brother of de Brazza,* crossed the upper Leko', or Likuala, and then traced that river to the Congo; Paul Crampel (1888–9) and Fourneau explored the country between the Ogowe and the frontier of German Camarons; Mizon came south from Yola, on the Benue (1892), and was met by Brazza himself on a tributary of the Sanga, which river had previously been explored by Cholet and Fourneau; Cholet pushed north as far as Ngauderi, in Southern Adamawa (1892–3); lastly, the region lying between the Ubangi and the Shari was reached by Paul Crampel, who perished in the attempt (1890); Jean Dybowski, who reached the Shari (1891); C. Maistre, who made his way from the Shari to the upper Benue (1892); and Gentil, who succeeded in reaching Lake Chad in October, 1897. But whilst geographical exploration thus made rapid progress, the colony made no progress economically, in spite of numerous "posts" and close upon three hundred officials, and French writers have contrasted this stagnation with the progress made by the Royal Niger Company in a much shorter time. De Brazza has been denied administrative ability, but part of the failure is no doubt due to the home authorities.

Disorders having taken place in the Congo, Pierre de Brazza was despatched at the head of a commission charged with investigating the subject. He left Marseilles on April 5 last, interviewed the Commissioner-General, E. Gentil, at Brazzaville, and then visited the frontier stations of the colony as far as Fort Crampel on the river Gribingi, a tributary of the Shari. He died on the homeward voyage, at Dakar, on September 14, only fifty-three years of age. E. G. R.

CORRESPONDENCE.

The Submarine Cañons of the Ganges and Indus.

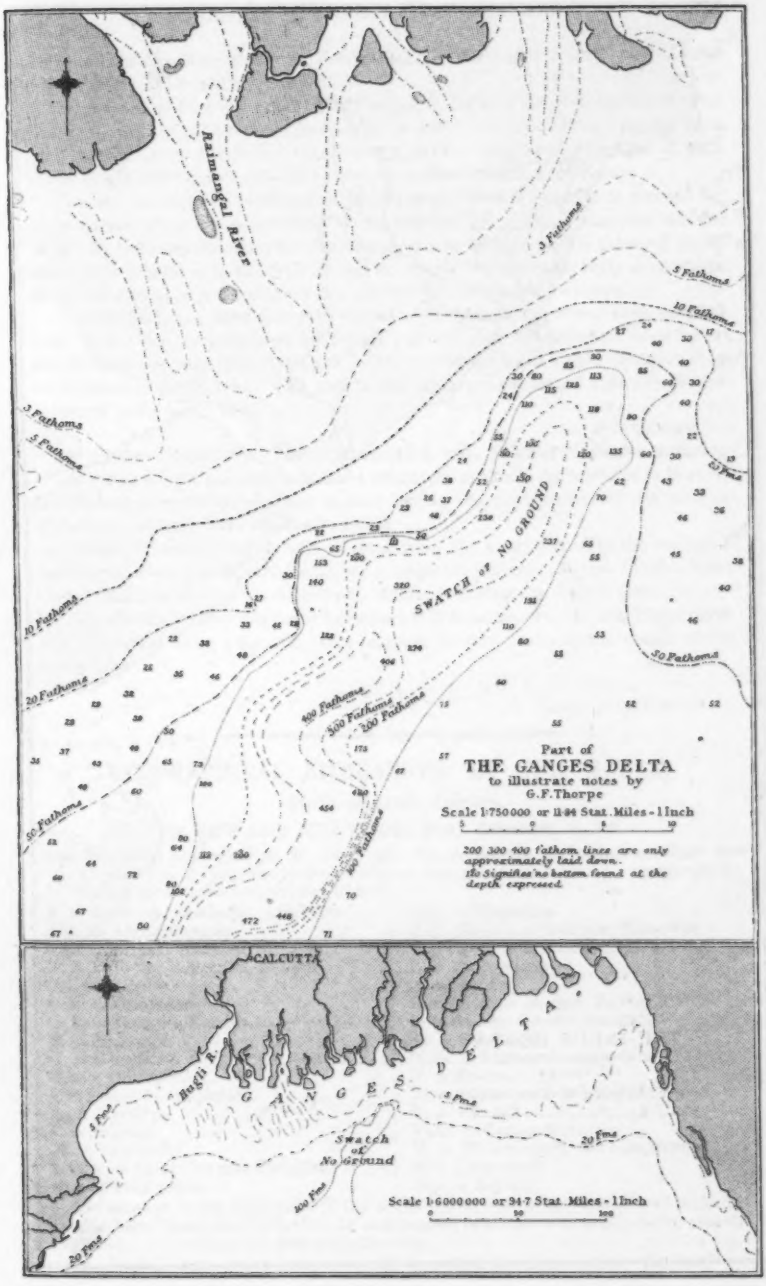
1, Garstin's Place, Calcutta, July 13, 1905.

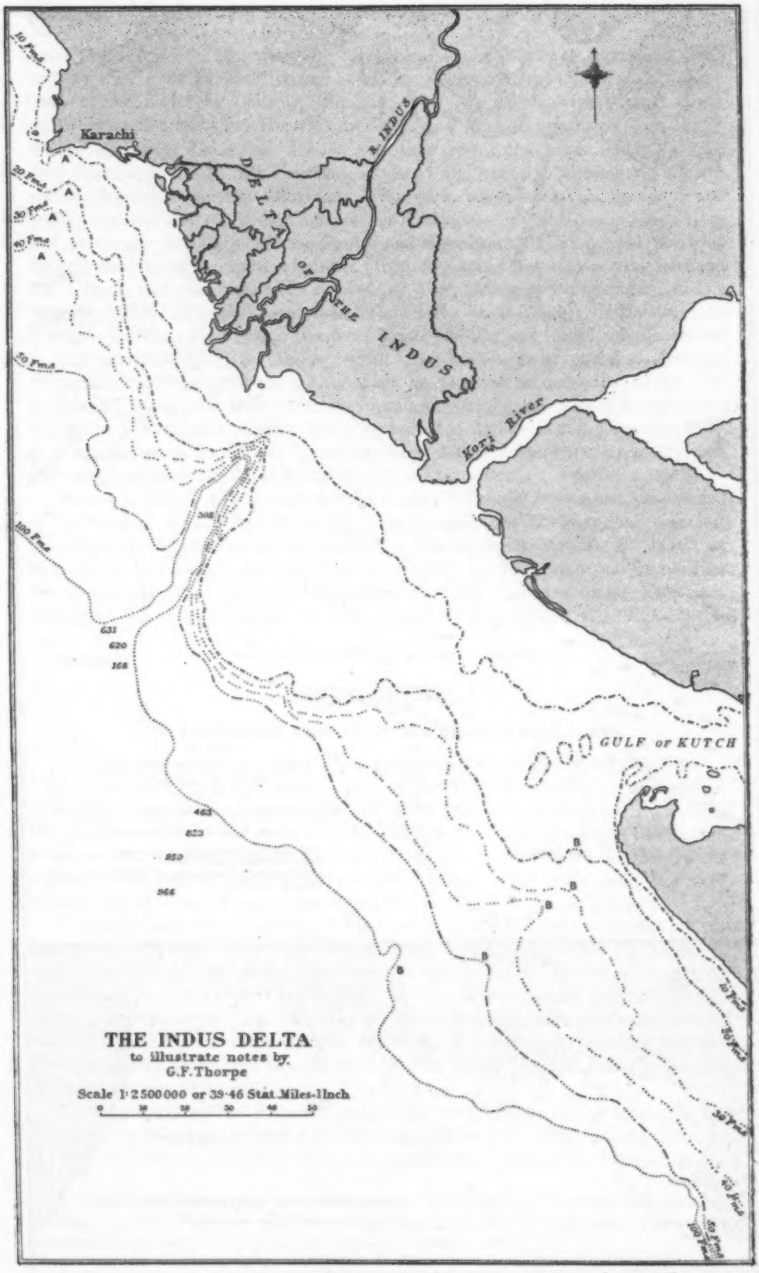
I HAVE just read Mr. J. W. Spencer's paper in the February issue of your magazine, in which he endeavours to prove the past raising of the American continent from the cañon existing off the mouth of the Hudson river. To a layman like myself it seems that, although when taken by itself and some other examples in the Atlantic it might be held to prove a past raising, when taken with the very similar ones existing off the Indian rivers, the proof is far from satisfactory.

I forward herewith a tracing of the Swatch of No Ground (so called) off the mouths of the Ganges, with the soundings taken in and around it, which, although unfortunately very few, are still sufficient to enable one to trace a very striking resemblance between it and the Hudson cañon. It is not only very nearly the same as regards depth and the changes of direction, but, curiously enough, it is situated in exactly the same position, viz. that off the Hudson pointing midway between its two banks, and that off the Ganges midway between the extreme east and west mouths of its delta.

Now, by applying Mr. Spencer's theory this would mean that in some past age Bengal must have been at least 3000 feet higher than it is at present, and probably if more and deeper soundings were taken, 9000 feet—the height allowed for the

* Giacomo de Brazza was born at Rome on December 14, 1859, and died there on February 3, 1888. Jointly with his companion, A. Pecile, he published 'Tre anni e mezzo nella regione del Congo e dell' Ogowe.' Roma: 1887.


Raimangal River
3 Fathoms
5 Fathoms
10 Fathoms
20 Fathoms
50 Fathoms
100 Fathoms
200 Fathoms
300 Fathoms
400 Fathoms
SWATCH of NO GROUND
Part of
THE GANGES DELTA
to illustrate notes by
G.F.Thorpe
Scale 1:750000 or 11·84 Stat. Miles - 1 Inch
200 300 400 fathom lines are only approximately laid down.
No Signifies no bottom found at the depth expressed.
CALCUTTA
Hugli R.
G A N G E S
D E L T A
5 Fms
20 Fms
100 Fms
Swatch of No Ground
Scale 1:6000000 or 94·7 Stat. Miles - 1 Inch


Karachi
R. INDUS
DELTA OF THE INDUS
Kori River
GULF or KUTCH
10 Fms.
20 Fms.
30 Fms.
40 Fms.
50 Fms.
100 Fms.
631
620
168
463
823
850
866
THE INDUS DELTA
to illustrate notes by
G.F.Thorpe
Scale 1:2500000 or 39·46 Stat.Miles-1Inch
0 10 20 30 40 50

American continent — would be the height, for the cañon is still very clearly defined where the soundings leave off.

Can this have been the case? The Ganges, so far as I know, drains a comparatively modern watershed; the greater part of lower Bengal has been built up from great depths by its silt, and it takes its rise in the Himalayas, which are of such recent origin that some authorities affirm they have not yet done rising.

It seems to me to be dead against Mr. Spencer's theory, and that to account for these cañons some other—probably a peculiar method of depositing the silt not at present understood—must be substituted, and in support of this theory I might draw your attention to the peculiar way in which the sands on both sides of the delta curve so as to point directly towards the deeper gut in the centre.

On the tracings I have given the names of the Admiralty charts from which I took them. All the soundings are correctly given, with the isobathic lines up to the 100 fathoms; the 200, 300, and 400 I have added myself, in the direction they most probably would take. The charts are easily procurable, so that any further reference could easily be got.

July 27, 1905.

In continuation of my letter dated the 13th inst., I forward herewith a tracing of the cañon off the Indus, which has a still more striking resemblance to that off the Hudson than the Ganges had, it even having the same secondary channels on either side, which I have marked A and B.

Although most of the soundings come from the chart named in the tracing, I have added some others gathered from a larger-scaled one, entitled 'India, West Coast: Chart of the Coasts of Sind and Kutch, including the Gulf of Cutch.'

Can the land surrounding ever have been 620 fathoms, or 3720 feet, higher than it is now—that being a sounding that seems to be very nearly at the mouth of the cañon?

G. F. Thorpe,
Bengal Pilot Service.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Carpathians. **Martonne.**

E. de Martonne. Étude sur la crue du Jiu au mois d'Août 1900. (Extras din Analele Institutului Meteorologic al României, T. xvi., 1900.) Bucuresci, 1903. Size 12½ × 9½, pp. 77–96. *Sketch-maps. Presented by the Author.*

Carpathians. **Martonne**

La période glaciaire dans les Karpates méridionales. Par E. de Martonne. (Comptes Rendus IX. Congrès géol. internat. de Vienne 1903.) Vienne, 1904. Size 10 × 7, pp. 691–702. *Map. Presented by the Author.*

Carpathians. *C. Rd.* **141** (1905): 71–73. **Murgoci.**

Contribution à la tectonique des Carpathes méridionales. Note de G. M. Murgoci.

Central Europe. *Petermanns M.* **51** (1905): 97–108. **Ihne.**

Phänologische Karte des Frühlingseinzugs in Mitteleuropa. Von Prof. Dr. E. Ihne. *With Map.*

Central Europe. **Regell.**

Das Riesen- und Isergebirge. Von P. Regell. (Land und Leute. Monographien zur Erdkunde . . . herausgegeben von A. Scobel. XX.) Bielefeld und Leipzig: Velhagen & Klasing, 1905. Size 10 × 7, pp. 132. *Map, Panorama, and Illustrations. Price 4 marks.*

An excellent account of the region in question, opening with a clear sketch of the physical geography.

Central Europe. *Meteorolog. Z.* **22** (1905): 282–284. **Ule.**

Niederschlag und Wasserführung der Flüsse Mitteleuropas. Von W. Ule.

Europe—Historical. **Helmolt and others.**

Weltgeschichte . . . herausgegeben von Hans F. Helmolt. Fünfter Band. Südosteuropa und Osteuropa. Von Prof. D. Rudolf von Scala, etc. Leipzig und Wien: Bibliographisches Institut, 1905. Size 10 × 7, pp. xvi. and 630. *Maps and Illustrations. Price 10s.*

Europe—Meteorology. **Rung.**

Répartition de la Pression atmosphérique sur l'Europe, observée de 1881 à 1895 et direction moyenne du vent sur les littoraux. Par le Capitaine G. Rung. Copenhague, 1904. Size 17 × 10½, pp. 20. *Maps. Price 21s. net.*

Færoes. **[Villiers.]**

Fishing, Whaling, and other Industries of the Faroe Islands, 1904. Foreign Office, Annual No. 3404. London, 1905. Size 9½ × 6, pp. 26. *Price 2d.*

Færoes and Iceland. **Nielsen.**

Meddelelser Kommissionen Havundersøgelser. Hydrografi I. No. 4 (pp. 30).

Hydrography of the Waters by the Faroe Islands and Iceland during the cruises of the Danish Research Steamer *Thor* in the summer 1903. By J. N. Nielsen. *Plates.*

France. *B.S.G. Com. Bordeaux* **31** (1905): 161–163. **Saint-Jours.**

Gironde, Garonne. Par Capitain Saint-Jours.

Discusses the history of the names.

France. *Rev. G.* **55** (1905): 140–145. **Pawlowski.**

Le marais vendéen: l'ancien golfe du Poitou. Par A. Pawlowski. *With Illustrations.*

France—Aude. *B.G. Hist. et Descriptive* (1904): 253–266. **Ferrasse.**

Les cours d'eau du bassin de la Cesse, leur origine, leur évolution. Par E. Ferrasse. *With Map.*

France—Brittany. **Martonne.**

Le développement des côtes bretonnes et leur étude morphologique. Par E. de Martonne. (Travaux du Laboratoire de Géographie de l'Université de Rennes No. 1.) Rennes: F. Simon, 1903. Size 10 × 6½, pp. 18. *Map. Presented by the Author.*

France—Brittany. **Martonne and Robert.**

Excursion Géographique en Basse Bretagne. (Monts d'Arrée-Trégorrois.) Par E. de Martonne et E. Robert. (Travaux du Laboratoire de Géographie de l'Université de Rennes, No. 3.) Rennes, 1905. Size 10½ × 6½, pp. 42. *Illustrations. Presented by M. E. de Martonne.*

France—Brittany. **Robert.**
Densité de la population en Bretagne, calculée par zones d'égal éloignement de la mer. Par E. Robert. (Travaux du Laboratoire de Géographie de l'Université de Rennes. No. 4.) Rennes, 1905. Size 10 × 6½, pp. 108. *Map. Presented by M. E. de Martonne.*

See Monthly Record for September (p. 328).

France—Climate. *B.S.G. Com. Bordeaux* **31** (1905): 141–156. **Courty.**
Climatologie du Littoral Atlantique Français. Par F. Courty.

France—Gascony. **Saint-Jours.**
B.S.G. Com. Bordeaux **30** (1904): 297–306, 330–334, 337–343, 357–365.
Le Port de Soulac, les Dunes et les Étangs de Gascogne. Par Cap. Saint-Jours.

France—Gironde. *B.G. Hist. et Descriptive* (1904): 239–244. **Duffart**
La navigation en Gironde d'après le Routier de Garcie dit Ferrande (XV^e^ Siècle). Par C. Duffart. *With Map.*

France—Gironde. *B.G. Hist. et Descriptive* (1904): 245–252. **Duffart.**
L'extension moderne de la presqu' île d'Ambès et de l'île du Cazeau (Gironde). Par C. Duffart. *With Maps.*

France—Glaciers. **Girardin and Favre.**
Commission française des Glaciers. Rapport sur les observations glaciaires en Maurienne, Vanoise, et Tarentaise (21 Août 24—Septembre, 1903). Par M. Paul Girardin. Observations sur les glaciers du Massif de la Vanoise, pendant l'été de 1903. Par le guide Joseph-Antoine Favre. Paris: P. Renouard, 1904. Size 9 × 5¼, pp. 48. *Map and Illustrations. Presented by the Commission.*

France—Historical. *B.G. Hist. et Descriptive* (1904): 147–160. **Soyer.**
Étude critique sur le nom et l'emplacement de deux oppida celtiques mentionnés par Jules César dans les *Commentarii de Bello Gallico.* Par J. Soyer. *With Map.*

France—Meteorology. **Sorre.**
Les pluies en Vendée. Par M. Sorre. (Travaux du Laboratoire de Géographie de l'Université de Rennes, No. 2.) Rennes, 1904. Size 10 × 6½, pp. 32. *Maps and Diagrams. Presented by M. E. de Martonne.*

France—Nomenclature. *B.G. Hist. et Descriptive* (1904): 223–238. **Chauvigné.**
Recherches sur les formes originales des noms de lieux en Touraine. Par A. Chauvigné.

France—Speleology. **Martel.**
E. A. Martel. Padirac et les Gorges du Tarn (Extrait du "Tour de France," Juin et Septembre, 1904). Rennes: F. Simon, 1905. Size 10 × 13, pp. 16. *Illustr.*

France—Survey. **Neymarch.**
Ministère des Finances. Commission Extraparlimentaire du Cadastre. Rapport Général et Rapport Complémentaire sur les Travaux de la Sous-Commission des Voies et Moyens. Par M. Alfred Neymarch. Paris, 1904. Size 12½ × 8½, pp. 150.

Germany. **1** *Veröffent. G.V. Bonn* (1905): 51–70. **Hassert.**
Deutschlands Lage und Grenzen in ihren Beziehungen zu Verkehr und Politik. Von K. Hassert.

Germany—Earthquake. *Globus* **87** (1905): 405–409. **Krebs.**
Erdbeben im deutschen Ostseegebiet und ihre Beziehungen zu Witterungs-Verhältnissen. Von W. Krebs. *With Map.*

Germany—Meteorology. *G. Anzeiger* **6** (1905): 27–30, 75–78. **Polis.**
Die Wärme- und Niederschlagsverhältnisse der Rheinprovinz. Von Dr. P. Polis. *Maps.*

Greece—Mountains. *Alpine J.* **22** (1905): 413–425. **Freshfield.**
Classical Climbs. By D. W. Freshfield.

Iceland. *G. Tidskrift* **6** (1882): 71–83, 103–111. **Helland.**
Om Islands Geologi. Af A. Helland.

Iceland. **Vidalin.**
Trade of Iceland, 1901–03. Foreign Office, Annual No. 3350, 1905. Size 10 × 6, pp. 16. *Price* 1*d.*

See note in Monthly Record for October (p. 451).

Iceland. *Alpine J.* **22** (1905): 436-448. **Wigner.**

The Vatna Jökull traversed from North-East to South-West. By J. H. Wigner. *With Illustrations.*

Italy. *B.S.G. Italiana* **6** (1905): 75–84. **Errera.**

Sulla separazione del Lago di Mezzola dal Lario (età antica e medievale). Nota del Prof. C. Errera.

Italy—Sicily. **Nicotra.**

Dizionario illustrato dei Comuni Siciliani compilato da F. Nicotra. Dispensa I. Palermo: Società editrice, [1905]. Size 12½ × 8½, pp. 1–64. *Illustrations. Presented by the Publishers.*

Magyar Race. **Zichy and Pósta.**

Dritte Asiatische Forschungsreise des Grafen Eugen Zichy. III. und IV. Archæologische Studien auf Russischem Boden. Von Béla Pósta. Parts i. and ii. Budapest; Leipzig: K. W. Hiersemann, 1905. Size 12½ × 9½, pp. 600. *Illustr.*

Norway. **Henriksen.**

On the Iron Ore Deposits in Sydvaranger, Finmarken, Norway; and relative geological problems. (By G. Henricksen.) Christiania, 1904. Size 7½ × 5½, pp. 8. *Presented by the Author.*

Pyrenees—Clouds. *Meteorolog. Z.* **22** (1905): 254–261. **Marchand.**

Marchand: Der Mechanismus der Entstehung der Regenwolken am Nordabhange der Pyrenäen. Einfluss der Erhebungen der Kette. Starke Regengüsse und Ueberschwemmungen.

Rumania. *M.G. Ges. Wien* **48** (1905): 231–232. **Weiss.**

Ein Beitrag zur antiken Topographie der Dobrudscha. Von Jacob Weiss. *Map.*

Russia. *B. Comité Géolog. St. Pétersbourg* **23** (1904): 243–250. **Kovalew.**

Compte rendu préliminaire des recherches géologiques dans l'Oural du Sud. Par P. Kovalew. [In Russian.]

Russia. **Woeikoff.**

Les ravins et les sables de la plaine Russe. Communication presentée au Congrès du Sud-Ouest Navigable de Toulouse. Par A. Woeikoff. Toulouse, 1904. Size 9½ × 6½, pp. 14.

Russia—Finland. *M.K.K.G. Ges. Wien* **48** (1905): 155–156. **Schoener.**

Die Kolonisation Südwest-Finnlands durch Schweden. Von J. G. Schoener.

Russia—Glaciers. **Shokalsky.**

Rapport sur les Observations des Glaciers en Russie pendant les années de 1902 et 1903. Par J. de Schokalsky. [In Russian.] St. Petersburg, 1905. Size 10 × 6½, pp. 22. *Illustrations. Presented by the Author.*

Russia—Kaluga. **Bogolubov.**

N. N. Bogolubov. Materials for the Geology of the Kaluga Government. [In Russian.] Kaluga, 1904. Size 11 × 8, pp. 354. *Maps and Illustrations. Presented by the Author.*

Russia—Kaluga. **Bogolubov.**

Zur geologischen Geschichte des Gouvernements Kaluga in der Glacialperiod. Notiz von N. Bogolübow. (Extrait de *l'Annuaire géologique et minéralogique de la Russie* (vol. 7, liv. 5).) St. Petersburg, 1905. Size 12½ × 9½, pp. 111–119. *Presented by the Author.*

Russia—Urals. *Le Globe B.S.G. Genève* **44** (1905): 122–124. **Duparc.**

Sur l'existence de hautes terrasses dans l'Oural du nord. Par Prof. Louis Duparc.

Spain. *C. Rd.* **141** (1905): 69–71. **Douvillé.**

Sur les Préalpes subbétiques aux environs de Jaen. Note de R. Douvillé.

Spain—Solar Eclipse. ——

Dirección General del Instituto Geográfico y Estadístico. Coordenadas geográficas de puntos comprendidos en la zona de la totalidad del Eclipse de Sol de 30 de Agosto de 1905. Madrid, 1905. Size 11 × 8, pp. 422. *Maps, Plans, and Illustrations. Presented by the Instituto Geografico y Estadistico, Madrid.*

Sweden. *B. Geolog. I. University Upsala* **6** (1902–03): 160–168. **Grenander.**

Les variations annuelles de la température dans les lacs suédois. Par S. Grenander.

Sweden. *B. Geolog. I. University Upsala* **6** (1902–03): 101–159. **Hofman-Bang.**
Studien über Schwedische Fluss- und Quellwässer. Von O. Hofman-Bang.

Sweden. *B. Geolog. I. University Upsala* **6** (1902–03): 175–199. **Högbom.**
Studien in nordschwedischen Drumlinslandschaften. Von A. G. Högbom. *With Maps and Illustrations.*

Switzerland. *Rev. Française* **30** (1905): 278–284. **Bobigny.**
Le Simplon et les voies d'accès. Par — Bobigny. *With Map.*

Switzerland—Geology. **Pannekoek, Arbenz, and Collet.**
Beiträge zur Geologischen Karte der Schweiz. 47. Lieferung. Geologische Aufnahme der Umgebung von Seelisberg, am Vierwaldstättersee. Von D. J. J. Pannekoek (pp. 26 and x.). Ditto. 48. Lieferung. Geologische Untersuchung des Frohnalpstockgebietes. Von D. Paul Arbenz. (Pp. x., 82, and x.) Ditto. 49e. Livraison. Etude Géologique de la Chaîne Tour Saillère—Pic de Tanneverge. Par Leon-W. Collet. (Pp. iv., 32, and xii.) Bern: A. Francke, 1904–1905. Size 12½ × 9½. *Maps and Illustrations.*

Turkey. *B.S.G. Română* **25** (1904): 136–147. ———
Statistica Comunelor Rominesti din Turcia. *Map.*
On Rumanians settled in Turkey.

Turkey—Macedonia. **Brancoff.**
D. M. Brancoff. La Macédoine et sa population chrétienne. Paris: Plon-Nourrit et Cie, 1905. Size 10 × 6½, pp. 270. *Maps. Price* 3*s.* 9*d.*

Turkey—Macedonia. *G.Z.* **11** (1905): 268–292. **Oestreich.**
Die Bevölkerung von Makedonien. Von Karl Oestreich.

United Kingdom—Archæology. *P.R.S. (Ser. A.)* **76** (1905): 177–180. **Lockyer.**
On the Observations of Stars made in some British Stone Circles. Preliminary Note. By Sir Norman Lockyer.

United Kingdom—Climate. *J.R. Statistical S.* **68** (1905): 247–319. **Shaw.**
Seasons in the British Isles from 1878. By Dr. W. N. Shaw, F.R.S. *With Maps.*
A valuable summary and analysis of climatic statistics, the relation between agriculture and weather being also considered.

United Kingdom—Coal. ———
Royal Commission on Coal Supplies. 13 Parts. London: Wyman & Sons, 1905. Size 13¼ × 8½. *Maps and Sections.*

United Kingdom—Devon. **Somervail.**
On the occurrence of Pleistocene Deposits in the bottom of the Teign gorge. By Alexander Somervail. (Pp. 4.) On the Excavation of the Teign Gorge. By the same. (Pp. 2.) Some further observations on the Teign and its valley. By the same. (Pp. 4.) The River Teign and its valley. By the same. (Pp. 10). (From *T. Devonshire Association*, 1901, 1902, and 1904.) Size 8½ × 6½. *Presented by the Author.*

United Kingdom—England. **Crook and Weston.**
Round the World Geographical Handbooks. I. Our English Home. By C. W. Crook and W. H. Weston. London: T. C. and E. C. Jack, [*not dated*]. Size 7 × 5, pp. 64. *Maps and Illustrations. Price* 6*d.* *Presented by the Publishers.*

United Kingdom—Geology. **Fox-Strangways and Watts.**
Memoirs of the Geological Survey, England and Wales. The Geology of the Country between Derby, Burton-on-Trent, Ashby-de-la-Zouch, and Loughborough. (Explanation of Sheet 141.) By C. Fox-Strangways. With a Chapter on Charnwood Forest by Prof. W. W. Watts. London, 1905. Size 10 × 6, pp. vi. and 84. *Illustrations.*

United Kingdom—Meteorology. *Nature* **72** (1905): 178–180. **Lockyer.**
The Thames Flow and British Pressure and Rainfall Changes. By Dr. W. J. S. Lockyer. *With Diagrams.*

United Kingdom—Scotland. *Scottish G. Mag.* **21** (1905): 289–301. **Shearer.**
The Evolution of the Map of Scotland. First Stage. By J. E. Shearer. *With Maps.*
See note in the September number (p. 327).

United Kingdom—Scotland—Anthropogeography. ———
The Geography of Religion in the Highlands. By a Member of the R.S. Geogr. Soc. Edinburgh: R. Grant, 1905. Size 8½ × 5½, pp. (36). *Presented by the Publishers.*

United Kingdom—Scotland—Hebrides. *Proc. R.S., Ser. A.* **76** (1905): 181–184. **Field.**

Report on an Area of Local Magnetic Disturbance in East Loch Roag, Lewes, Hebrides. By Captain A. M. Field. *Diagrams.*

United Kingdom—Wiltshire. **Jukes-Browne.**

Memoirs of the Geological Survey, England and Wales. Explanation of Sheet 282. The Geology of the Country South and East of Devizes. By A. J. Jukes-Browne. London, 1905. Size 9¼ × 6, pp. 62. *Price* 1*s.* *Presented by the Geological Survey.*

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China—Trade.

China: Imperial Maritime Customs. I. Statistical Series, Nos. 3 and 4. Returns of Trade and Trade. Reports. 1904. Part i. Size 11 × 9, pp. xvi. and [64]. [In English and Chinese.] *Diagrams.*

China—Yunnan. **Sainson.**

Nun-tchao ye-che. Histoire particulière du Nan-tchao, traduction d'une histoire de l'ancien Yun-nan, accompagnée d'une Carte et d'un Lexique géographique et historique. Par C. Sainson. (Publ. l'École Langues Orient. Viv. V^e^ Sér., Tome IV.) Paris: E. Leroux, 1904. Size 11 × 7½, pp. 294. *Map.* *Price* 15 *fr.*

Chinese Empire—Manchuria. *J. Tōkyō G.S.* **17** (1905): 155–162. **Ogawa.**

On the Geology of Liau-tung. By Takudzi Ogawa. [In Japanese.]

Chinese Empire—Tibet. *Records Geolog. Surv. India* **32** (1905): 160–174. **Hayden.**

Preliminary Note on the Geology of the Provinces of Tsang and Ü in Tibet. By H. H. Hayden. *With Map.*

Chinese Empire—Tibet. **Hosie.**

China, No. 1 (1905). Report by Mr. A. Hosie, His Majesty's Consul-General at Chengtu, on a journey to the Eastern Frontier of Thibet. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 88. *Map.* *Price* 1*s.* 3*d.*

Noticed in the Monthly Record for October (p. 452).

Chinese Empire—Tibet. *J.R. United Service I.* **49** (1905): 659–679. **Iggulden.**

To Lhasa with the Tibet Expedition, 1903–04. By Lieut.-Colonel H. A. Iggulden. *With Map and Illustrations.*

Chinese Empire—Tibet—Orthography. **O'Connor.**

Rules for the Phonetic Transcription into English of Tibetan Words. (By Captain W. F. O'Connor.) Size 13½ × 8½, pp. 6.

Eastern Asia. *J.R. Colon. I.* **36** (1905): 509–539. **Ireland.**

The British Empire in the Far East. By A. Ireland.

Eastern Asia. **Halot.**

L'Extrême-Orient. Études d'hier, événements d'aujourd'hui. Par A. Halot. Avec une Préface de M. Revon. Bruxelles: Falk Fils, 1905. Size 7½ × 5, pp. 212. *Map.* *Presented by the Publisher.*

The writer went out to Japan, some years ago, with a view to studying the burning questions of the Far East with an absolutely unbiassed mind. He here gives the results of his observations in a series of essays dealing chiefly with the moral causes of the war of 1894–95.

French Indo-China.

Publications de la Société des Études Indo-Chinoises. Géographie physique économique et historique de la Cochinchine. Fasc. I.–VI. I. Monographie de la Province de Biên-hòa (pp. xii. and 58); II. Province d'Hà-tiên (pp. 66); III. Province de Gia-dinh (pp. 140); IV. Province de Mŷ-tho (pp. 98); V. Province de Bà-ria et de la Ville du Cap Saint-Jacques (pp. 66); VI. Province de Châu dôc (pp. 56). Saigon, 1901–2. Size 10 × 6½. *Maps and Illustrations.* *Price* 20*s.*

French Indo-China—Annam. *R. Française* **30** (1905): 342–351. **Lasalle.**

Les Côtes de l'Annam. Par C. de Lasalle. *Map.*

French Indo-China—Laos. *B.G. Hist. et Descriptive* (1904): 283–389. **Bernard.**

Les Khâs, peuple inculte du Laos français. Notes anthropométriques et ethnographiques. Par M. le Dr. Noël Bernard. *With Map and Plates.*

French Indo-China—Tongking. *B.S.G. Marseille* **28** (1904): 388–401. **Gérard.**

L'Ile de Kébao (Tonkin). Par A. Gérard. *With Map.*

India. *P.R.S., Ser. A.* **76** (1905): 313–315. **Burrard.**

On the Intensity and Direction of the Force of Gravity in India. By Lieut.-Colonel S. G. Burrard. (Abstract.)

India. **Gage.**

Annual Report of the Board of Scientific Advice for India for the year 1903–1904. Calcutta, 1905. Size 13 × 8½, pp. 22. *Price 7d.*

A summary of the Departmental reports (surveys, etc.)

India—Bengal and Assam. ——

Papers relating to the Reconstitution of the Provinces of Bengal and Assam. London: Wyman & Sons, 1905. Size 13½ × 8½, pp. 18. *Price 2½d.*

See Monthly Record for September (p. 330).

India—Ethnology. *C. Rd.* **140** (1905): 1656–1659. **Lapicque.**

Recherches sur l'ethnogénie des Dravidiens. Relations anthropologiques entre les tribus de la montagne et les castes de la plaine. Note de L. Lapicque.

India—Historical. *Indian Antiquary* **34** (1905): 73–87. **Stein.**

White Huns and kindred tribes in the history of the Indian North-West Frontier. By M. A. Stein.

Indo-China—Ethnology. *Rev. Coloniale* (1905): 321–334. **Cabaton.**

Les Chams de l'Indo-Chine. Par Antoine Cabaton.

Indo-China—Historical. *J. China Br. R. Asiatic S.* **35** (1903–4): 76–101. **Kingsmill.**

The Mantses and the Golden Chersonese. By T. W. Kingsmill.

Japan. *J. Tōkyō G.S.* **17** (1905): 53–60, 119–125. **Gakujin.**

Contributions to the Oceanography of the Tōkyō Bay. By Chinzan-Gakujin. [In Japanese.]

Japan. *J. Tōkyō G.S.* **17** (1905): 20–24. **Tanaka.**

The Temperature of Water of the Brackish Lake Hiruiga, Wahasa Province. By Akamaro Tanaka. [In Japanese.]

Japan. ——

The Fifth Financial and Economical Annual of Japan, 1905. Tokyo. Size 10½ × 7½, pp. vi., 182, and 30. *Map and Diagrams. Presented by Dr. Y. Sakatani.*

Japan—Formosa. **Crowe.**

Trade of North Formosa, 1904. Foreign Office, Annual No. 3405. London, 1905. Size 9½ × 6, pp. 18. *Price 1½d.*

Japan—Seismology. *J. Tōkyō G.S.* **17** (1905): 183–193. **Ōmori.**

On the Distribution of Earthquakes in Japan. By Fusakichi Ōmori. [In Japanese.] *Maps.*

Japan—Seismology. *J. Tōkyō G.S.* **17** (1905): 375–382. **Omori.**

On the Recent Volcanic Eruption in Japan. By Fusakichi Omori. [In Japanese.] *Diagrams.*

Korea. *B.S.R.G. Anvers* **29** (1905): 75–142. **Schmidt auf Altenstadt.**

Reisindrukken van een Hollandsche in Korea. Door von Schmidt auf Altenstadt.

Malay Archipelago—Borneo. *Scottish G. Mag.* **21** (1905): 312–315. **Burt.**

Notes on a Journey through British North Borneo. By A. Burt.

Malay Archipelago—Celebes. *Petermanns M.* **51** (1905): 118. **Hoëvell.**

Ueber die Herkunft des Namens "Celebes." Von Baron G. W. W. C. von Hoëvell.

See Monthly Record for October (p. 453).

Malay Archipelago—Gilolo. **Hueting.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **22** (1905): 604–620.

Het district Tobelo op de Oostkust van Halmahera. Door A. Hueting. *Map.*

Malay Archipelago—Java and Madura.

Rapporten van de Commissie in Nederlandsch-Indië voor oudheidkundig onderzoek op Java en Madoera. 1903. Uitgegeven voor rekening van het Bataviaasch Genootschap van Kunsten en Wetenschappen. Batavia: Albrecht & Co.; 's Gravenhage: M. Nijhoff. 1905. Size 11 × 7½, pp. iv. and 78. *Plates.*

Malay Archipelago—Sumatra. *Z. Ges. E. Berlin* (1905): 251. **Erb.**

Beiträge zur Geologie und Morphologie der südlichen Westküste von Sumatra. Von D. J. Erb. *Illustrations.*

Noticed in the September number (p. 332.)

Malay Archipelago—Sumatra. **Westenberg.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **22** (1905): 576–603.
Bataksche rijkjes Dolok en Poerba, ontleend aan eene nota dd. 29 Juli 1903, van den toenmaligen controleur voor de Bataksche aangelegenheden C. J. Westenberg.

Malay Archipelago—Sumatra—Triangulation. **Muller.**
Tijds. K. Ned. Aaard. Genoots. Amsterdam **22** (1905): 567–575.
De aansluiting van het driehocksnet van Zuid-Sumatra aan het net van Sumatra's Westkust. Door Dr. J. J. A. Muller.

Malay Peninsula. *Rev. G.* **54** (1904): 297–306, 355–364; **55** (1905): 109–119. **Barré.**
La péninsule malaise. Par P. Barré. *With Map and Illustrations.*

Persia—Sistan. *B. American G.S.* **37** (1905): 271–281. **Huntington.**
The Depression of Sistan in Eastern Persia. By Ellsworth Huntington. *With Maps.*

Persian Gulf. **[Richards.]**
Diplomatic and Consular Reports. No. 3408, Annual Series. Persia. Report for the Year 1904 on the Trade and Commerce of the Persian Gulf. London: Harrison & Sons, 1905. Size 9½ × 6, pp. 50. *Price* 4½*d.*

Philippine Islands. **Jenks.**
Dept. of the Interior. Ethnological Survey Publications. Vol. i. The Bontoc Igorot. By A. E. Jenks. Manila, 1905. Size 10½ × 7½, pp. 266. *Maps and Illustrations. Presented by the Ethnological Survey for the Philippine Islands.*
A well-nigh exhaustive account of the life, customs, and occupations of one of the primitive mountain tribes of Luzon, based on five months' residence among them.

Russia—Caucasus. *Globus* **88** (1905): 21–25. **Hahn.**
Die Täler der "Grossen Ljachwa" und der Ksanka (Ksan) und das südliche Ossetien. Von C. von Hahn.

Russia—Caucasus. *Beiträge Geophysik* **7** (1905): 411–414. ——
Ausbruch des Schlammvulkans Otman-Basy-Dag bei Baku am 23. November 1904.

Russia—Siberia. *L'Esploraz. Com.* **20** (1905): 161–172. **Grasso.**
Le vie fluviali della Siberia in rapporto alle attuali comunicazioni russe coll' Estremo Oriente. G. Grasso.

Russia—Siberia. *Dutsch. Rundschau G.* **27** (1905): 398–405. **Miller.**
DasLand der Jakuten. Von A. Miller. *With Illustrations.*

Russia—Siberia. **Turner.**
Siberia: A Record of Travel, Climbing, and Exploration. By S. Turner. London: Fisher Unwin, 1905. Size 9 × 6, pp. xxiv. and 420. *Maps and Illustrations. Price* 21*s. net. Presented by the Publisher.* [To be reviewed.]

Russia—Siberia—Trade. **Cooke.**
Report on the Condition and Prospects of British Trade in Siberia. By H. Cooke. London, 1905 (Cd. 2518). Size 13 × 8½, pp. xiv. and 104. *Map. Price* 1*s.* 3*d.*

Russian Central Asia. *Appalachia* **11** (1905): 17–26. **Huntington.**
With a Minbashi in Turkestan. By Ellsworth Huntington. *Plates.*

Russian Central Asia—Language. **Olufsen.**
The Second Danish Pamir-Expedition. A Vocabulary of the Dialect of Bokhara. By O. Olufsen. Kopenhagen, 1905. Size 10 × 7, pp. 60. *Presented by Lieut. O. Olufsen.*

Turkey—Arabia. **Grey.**
Trade of Muskat, 1904–05. Foreign Office, Annual No. 3415, 1905. Size 9½ × 6, pp. 10. *Price* 1*d.*

Turkey—Syria. **Smith.**
Palestine Exploration Fund Quarterly Statement (1905): 219–230.
Callirrhoe and Machærus. By Prof. G. A. Smith. *Plan and Illustrations.*

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Abyssinia. *B.S.G. Italiana* **6** (1905): 8–18, 100–118. **Felizzano.**
Nei Paesi Galla a sud dello Scioa. Relazione di viaggio del capitano conte G. Colli di Felizzano. *With Map.*

Azores. **Read.**
Trade of the Azores, 1897–1904. Foreign Office, Annual, No. 3356, 1905. Size 10 × 6, pp. 8. *Price* ½*d.*

Canary Islands. *B.R.S.G. Madrid, Rev. G. Colon* **3** (1905): 91–99. **Manrique.**
La Isla de la Palma (Canarias). Consideraciones acerca del origen del nombre de esta isla. Por A. M. Manrique.

Central Africa—Tanganyika. *B.S.R. Belge G.* **29** (1905): 113–126. **Zels.**
Le Problème du Tanganyika. Par L. Zels.

Congo—Historical. ——
A inscripção de Diogo Cão na cataracta de Jellala (no Zaire) foi destruida? (From the *Mala da Europa* February 26, 1905.) Lisbon, 1905. *Illustrations.*

Congo State—Katanga. *Mouvement G.* **22** (1905): 199–203. **Jacques.**
L'exploration du Capitaine Jacques et le chemin de fer du Katanga. *With Map.*

East Africa. *L'Esplorazione Commerciale* **20** (1905): 179–189. **Alamanni.**
Benadir e Africa Orientale. Di Ennio Alamanni.

East Africa. **Voeltzkow.**
Z. Ges. E. Berlin (1903): 560–591; 1904: 274–301, 426–451; 1905: 89–119, 184–221, 285–296.
Berichte über eine Reise nach Ost Afrika zur Untersuchung der Bildung und des Aufbaues der Riffe und Inseln des westlichen Indischen Ozeans. Von Prof. Dr. Alfred Voeltzkow. *Maps.*

Egypt. *B.S. Khédiv. G.* **6** S. (1905): 325–364. **Fourtau.**
La cataracte d'Assouan. Par R. Fourtau. *With Map and Illustrations.*

Egypt and the Sudan. **[Cromer.]**
Egypt. No. 1 (1905). Reports by His Majesty's Agent and Consul-General on the Finances, Administration, and Condition of Egypt and the Soudan in 1904. London: Wyman & Sons, 1905. Size 13 × 8½, pp. vi. and 150. *Price* 1*s.* 3*d.*
See note in the Monthly Record for August (p. 216).

Egyptian Sudan. *B.S.G. Italiana* **6** (1905): 84–100. **Tappi.**
Nel Bahr el Gazal, lettera del missionario padre C. Tappi.

German Colonies. *Deutsche Kolonialz.* **22** (1905): 132, 143–144. **Schwabe.**
Ueber die Entwicklung der Verkehrsverhältnisse in unseren afrikanischen Schutzgebieten. Von Schwabe.

German East Africa. *Koloniale Z.* **6** (1905): 147–148. **Herfurth.**
Die ostafrikanische Südbahn. Von A. Herfurth.

German East Africa. *Z. Ges. E. Berlin* (1905): 215–217. **Jaeger.**
Bericht über den Anfang der deutsch-ostafrikanischen Expedition der Otto Winter-Stiftung unter Leitung von Prof. Dr. C. Uhlig. Von Dr. Fritz Jaeger.

German East Africa. *Z. Ges. E. Berlin* (1905): 120–123. **Uhlig.**
Bericht über die Expedition der Otto Winter-Stiftung nach dem Umgebungen des Meru. Von Dr. C. Uhlig.
See *Journal*, vol. **25**, p. 566.

German South-west Africa. *Z. Kolonial politik.* **7** (1905): 301–311. **Gessert.**
Die Grundwasserverdunstung in Steppen speciell Sudwestafrika. Von Ferdinand Gessert.
Noticed in the Monthly Record (*ante*, p. 557).

German South-west Africa. *G. Anzeiger* **6** (1905): 97–100. **Seidel.**
A. Kuhns Expedition am Grossen Fischfluss (Deutsch-Südwestafrika). Von H. Seidel.

German South-west Africa. *Globus* **88** (1905): 9–14. **Seiner.**
Der Omuramba Omatako und die Omatakoberge. Von F. Seiner. *With Illustrations.*
The Omatako is one of the few watercourses of any importance in this arid country.

German South-west Africa. *Deutsch. Rundschau G.* **27** (1905): 337–345. **Seiner.**
Die Omaheke der Herero. Von F. Seiner. *With Illustrations.*

Kamerun. *M. Deutsch. Schutzgeb.* **18** (1905): 59–88. **Ambronn.**
Bericht über die astronomisch-geodätischen Beobachtungen der Expedition zur Festlegung der Grenze Yola-Tschadsee zwischen Nordwest-Kamerun und Northern Nigeria. Von Prof. Dr. Ambronn. *With Illustrations.*

Kamerun. *M. Deutsch. Schutzgeb.* **18** (1905): 89–91. **Förster.**
Auszugsweise Zusammenstellung nach Tagebuchnotizen über die Niederschlags- und Wasserstandsverhältnisse im Sanga-Ngoko-Gebiet. Von Oberleutnant Förster.

Kamerun. **Kaiser.**
Handel und wirtschaftliche Verhältnisse des nordwestlichen Teiles von Kamerun. (Separatabdruck aus den "Mitteilungen der Ostschweizerischen Geograph.-Commerc. Gesellschaft.") Von A. Kaiser. Size 9 × 6, pp. 46. *Presented by the Author.*

Kamerun. **René.**
Kamerun und die Deutsche Tsâdsee-Eisenbahn. Von C. René. Berlin: E. S. Mittler und Sohn, 1905. Size 9½ × 6½, pp. x. and 252. *Maps and Illustrations. Price* 6*s.* 6*d.*

Lake Nyasa. *Deutsch. Kolonialzeitung* **22** (1905): 153–154. **Prager.**
Die Inseln im Nyassasee. Von Captain M. Prager. *With Illustration.*

Madagascar. **Petit-Nicolas.**
Rev. Madagascar **6** (1) (1904): 219–237; **6** (2) (1904): 295–303, 447–457; **7** (1) (1905): 47–59, 219–231, 396–418.
Notes sur le Pays Sakalave. Par — Petit-Nicolas. *With Illustrations.*

Madagascar—Ethnography. **Vacher.**
Rev. Madagascar **9** (1903): 323–339, 385–423, 498–519; **10** (1904): 3–25, 106–130; **11** (1904): 136–150, 324–336; **12** (1905): 419–432, 508–522.
Études Ethnographiques. Par le Captain Vacher. *Maps.*

Morocco. **Bihot.**
Le Maroc, étude de géographie politique par C. Bihot. (Travaux du Séminaire de Géographie de l'Université de Liége, ii.) Liége: D. Cormaux, 1905. Size 10 × 6½, pp. 50. [Also in *B.S R.G. Anvers* **29** (1905): 5–50.]

Morocco. *B. Comité Afrique Française* **15** (1905): 192–200. **Segonzac.**
La Mission Segonzac: Exposé de MM. de Segonzac, Gentil et de Flotte. *With Maps.*
See Monthly Record for September (p. 333).

Morocco. *Renseignements Colon., Comité Afrique Française* (1905): 205–210. **Segonzac.**
La pénétration économique du Sud marocain: Rapport au Comité du Maroc. Par le Marquis de Segonzac.

Nigeria. *J. African S.* **4** (1905): 417–426. **Merrick.**
The Bolewa tribe. By Major G. Merrick.

Nigeria—Historical. *J. African S.* **4** (1905): 455–479. **Mischlich.**
Contributions to the History of the Hausa States. By A. Mischlich. With Introduction by J. Lippert.

North Africa. *Rev. G.* **55** (1905): 148–154. **Dupontès.**
A travers l'Afrique romaine. Par P. C. Dupontès. *With Map and Illustrations.*

Portuguese West Africa—Meteorology. *B.S.G. Lisbon* (1905): 197–218. **Roque.**
Contribuição para o estudo do clima do planalto de Mossamedes. Por A. B. Roque. *Map and Diagrams.*

Sahara. *Renseignements Colon., Comité Afrique Française* (1905): 265–267. **Mercier.**
Une harka des Doui Menia et Ouled Djerir vers le Sahel. Par L. Mercier.
Native account of a raid, by tribes of the Morocco-Algerian borderlands in the Northern Sahara, in the direction of Timbuktu.

Sahara—Tuareg. **Ahmed Bilou.**
Renseignements Coloniaux, Comité de l'Afrique française (1905): 182–187.
Le Voyage du Caïd El Hadj Ahmed Bilou chez les Touareg.
This journey, by a native in the French service, took place in 1903.

South Africa. *T.S. African Philosoph. S.* **16** (1905): 53–70. **Du Toit.**
The forming of the Drakensberg. By A. L. du Toit. *With Map.*

South Africa. *Globus* **87** (1905): 229–234, 295–301. **Passarge.**
Die Mambukuschu. Von S. Passarge. *With Illustrations.*
The headquarters of the Mambukushu are about the cataracts of the Okavango. The articles describe their characteristics and culture.

South Africa—Kalahari. *Z. Ges. E. Berlin* (1905): 20–36, 68–88. **Passarge.**
Die Grundlinien im ethnographischen Bilde der Kalahara Region. Von Dr. S. Passarge. *Maps and Illustrations.*

South Africa—Kalahari. *B.S.R. Belge G.* **29** (1905): 93–112. **Schoep.**
Le Kalahari. Par A. Schoep.

Sudan. *B. Comité Afrique Française* **15** (1905): 290–292. **Jolyet.**
La question forestière dans le Soudan. Par A. Jolyet.
The writer thinks that the wooded regions of the Sudan may be capable of limited exploitation, given suitable methods of forestry.

Transvaal—Geology. *T. Geol. S. South Africa* **8** (1905): 16–25. **Molengraaff.**
Notes on the Geology of a Portion of the Klerksdorp District, with Special Reference to the Development of the Lower Witwatersrand Beds and the Vaal River System. By G. A. F. Molengraaff. *Map and Sections.*

Transvaal—Geology. *T. Geol. S. South Africa* **8** (1905): 42–46. **Merensky.**
The Gold Deposits of the Murchison Range in the North-Eastern Transvaal. By Hans Merensky.

Tristan da Cunha. *T.S. African Philosoph. S.* **16** (1905): 9–51. **Schwarz.**
The Rocks of Tristan d'Acunha, brought back by H.M.S. *Odin*, 1904, with their bearing on the question of the Permanence of Ocean Basins. By E. H. L. Schwarz. *With Maps and Section.*
Noticed in the Monthly Record for October (p. 458).

Tristan da Cunha. *Scottish G. Mag.* **21** (1905): 301–309. ——
Tristan d'Acunha. *With Portraits.*

NORTH AMERICA.

Canada—Rockies. *Smithsonian Miscellaneous Collections* **2** (1905): 453–496. **Sherzer.**
Glacial Studies in the Canadian Rockies and Selkirks. Preliminary Report by D. W. H. Sherzer. *Illustrations.*

Mexico. *J. Geol.* **13** (1905): 185–193. **Darton.**
The Zuni Salt Lake. By N. H. Darton. *Maps and Illustrations.*
See Monthly Record (p. 560).

Mexico. *Science* **21** (1905): 585–587, 897–899. **Hovey.**
The Western Sierra Madre Mountains. (The Greene Exploring Expedition.) By Dr. E. O. Hovey.

North America. **Preuss and Seler.**
Z. Ges. E. Berlin (1905): 361–380, 433–466.
Der Einfluss der Natur auf die Religion in Mexiko und den Vereinigten Staaten. Von Dr. K. Th. Preuss. *Illustrations.*
Einige Bemerkungen zu dem Aufsatze Dr. K. Th. Preuss über den Einfluss der Natur auf die Religion in Mexiko und den Vereinigten Staaten. Von Prof. Dr. Seler.
Antwort auf Prof. Dr. Selers Bemerkungen zu meinem Vortrage. Von Dr. K. Th. Preuss.

North America—Historical. **Schafer.**
A History of the Pacific North-West. By Joseph Schafer. New York: The Macmillan Co., 1905. Size 7½ × 5½, pp. xvi. and 322. *Maps and Illustrations. Price* $1.25 *net. Presented by the Publishers.*
An excellent short history of the discovery and development of the north-west of North America, especially within the United States. The exploration of the west of Canada is touched upon here and there, but only incidentally. Thus no mention is made of the important journeys of Robert Campbell in the far North-West.

United States. *B. American G.S.* **37** (1905): 321–339. **Brigham.**
The Great Roads across the Appalachians. By A. P. Brigham.

United States—Arizona. *Deutsch. Rundschau G.* **27** (1905): 358-363. **Kuntze.**
Der Achatwald von Adamana. Von Dr. O. Kuntze. *With Illustration.*
On forest trees petrified *in situ.*

United States—Census. ———
Bureau of the Census. Bulletin 15. A Discussion of the Vital Statistics of the Twelfth Census. Washington, 1904. Size 11½ × 9, pp. 24.

North America—Great Lakes. *Monthly Weather Rev.* **33** (1905): 154. **Odenbach.**
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Finger Lake Region of Western New York. By C. R. Dryer. *With Map and Illustrations.*

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Topography and Travel in Pennsylvania. By W. S. Tower.

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The Tertiary History of the Tennessee River. By Douglas Wilson Johnson. *Map and Sections.*
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The Glacial Features of the St. Croix Dalles Region. By Rollin T. Chamberlin. *With Maps.*

CENTRAL AND SOUTH AMERICA.

Brazil—Historical. ——

The Dutch on the Amazon and Negro in the Seventeenth Century. London, [*not dated*]. Size 13½ × 8½, pp. 28. *Presented by the Foreign Office.*

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Report of a visit to the ruins on the Colombia branch of the Rio Grande. By Dr. T. Gann.

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Die Zukunft der mittelamerikanischen Indianerstämme. Von Karl Sapper.

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El Bajo Urubamba. Por L. M. Robledo.

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El "Huascaran." Apuntes sobré su última ascensión. Por C. Reginald Enock.

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Nuevas Exploraciones en la Hoya del Madre de Dios. Publicación de la Junta de Viás Fluviales. Lima, 1904. Size 13 × 9, pp. xxviii. and 186. *Maps and Illustrations.*

Contains large-scale maps of portions of the Tambopata and neighbouring rivers.

Peru—Surveys. **La Combe, Von Hassel, and Pesce.**

El Istmo de Fiscarrald. Informes de los Señores La Combe, Von Hassel, y Pesco. Publicación de la Junta de Vias Fluviales. Lima, 1904. Size 13 × 9, pp. vi. and 230. *Maps and Illustrations.*

Further results of the expeditions organized by the Junta in 1901 and following years (cf. *Journal*, vol. **23**, p. 604 *et seq.*).

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Des Andes au Para. Par V. Jottrand. *With Illustrations.*

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Friendly Islands. **Hunter.**

Trade of the Friendly Islands, 1902–04. Foreign Office, Annual No. 3406. London, 1905. Size 9½ × 6, pp. 14. *Price* 1*d.*

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Zur Geographie des Schutzgebietes von Deutsch-Neu-Guinea. Von Dr. A. Hahl.

Marianne Islands—Guam. *National G. Mag.* **16** (1905): 229–237. **Safford.**
Our Smallest Possession—Guam. By W. E. Safford. *With Illustrations.*

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The Geology of the Kiama-Jamberoo District. By J. B. Jaquet, G. W. Card, and L. F. Harper. *With Map and Illustrations.*

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The Geography of New Zealand—Historical, Physical, Political, and Commercial. By Dr. P. Marshall. With Contributions by Prof. J. W. Gregory, A. Hamilton, and G. Hogben. Christchurch, N.Z., etc.: Whitcombe and Tombs, [*not dated*]. Size 7½ × 5, pp. x. and 402. *Maps and Illustrations. Price* 4*s.* 6*d. net. Presented by the Publishers.*

The subject appears to be treated in a thoroughly scientific manner, with full knowledge of the recent developments in geographical methods.

Pacific Ocean—Pitcairn Island. **Simons.**
Pitcairn Island. Report by Mr. R. T. Simons. Colonial Reports, Miscellaneous, No. 30. Size 9½ × 6, pp. 12. *Price* 1*d.*
See note in Monthly Record for October (p. 456).

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Sapphire Fields of Central Queensland. Notes on their present condition. By Lionel C. Ball. *Illustrations.*

Victoria. *Petermanns M.* **51** (1905): 118–119. **Lendenfeld.**
Die heissen Winde in Melbourne. Von R. von Lendenfeld.

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The Voyage of the *Discovery*. By Captain R. F. Scott. 2 vols. London: Smith, Elder & Co., 1905. Pp. (vol. i.) xx. and 556; (vol. ii.) xii. and 508. *Maps and Illustrations. Price* 42*s. net. Presented by the Publishers.* [To be reviewed.]

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Ancient Antarctica. By F. W. Hutton.

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A quoi servent les explorations antarctiques. Par E. A. Martel. *With Illustrations.*

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Preliminary Notes on Observations made with a Horizontal Pendulum in the Antarctic Regions. By J. Milne, F.R.S.

The observations were made by Mr. Bernacchi during the British Antarctic Expedition.

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The Recent Voyage of the *Uruguay*. By R. C. Mossman. *With Chart and Illustrations.*

Antarctic—Meteorology. *Symons' Meteorolog. Mag.* **40** (1905): 86–89. **Mossman.**
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Antarctic—Rocks. *B. Geolog. I. University Upsala* **6** (1902–03): 234–246. **Nordenskjöld.**
Petrographische Untersuchungen aus dem westantarktischen Gebiete. Vorläufige mitteilung von O. Nordenskjöld. *With Maps. Also separate copy.*

Antarctic—Scottish Expedition. *Scottish G. Mag.* **21** (1905): 322–323. **Bruce.**
Scottish National Antarctic Expedition. Outline Map of Laurie Island, South Orkneys, 1903. By W. S. Bruce. *With Map.*

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On the design of the Antarctic Exploration Vessel *Discovery*. By W. E. Smith, C.B. 1905. Size 11½ × 9, pp. 40. *Illustrations.*

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Altitudes. *C. Rd.* **141** (1905): 153–155. **Teisserenc de Bort.**

Verification des altitudes barométriques par le visée directe des ballons sondes. Note de L. Teisserenc de Bort.

Cartography. **Penck.**

Fortschritte in der Herstellung einer Erdkarte im Masstabe 1:1,000,000. Von Albrecht Penck. *With Map. Also separate copy, presented by the Author.*

Figure of the Earth. *Beiträge Geophysic* **7** (1905): 283–326. **Arldt.**

Die Gestalt der Erde. Von Dr. T. Arldt. *With Maps.*

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Uncharted Rocks in Well-used Trade Routes. *Illustration.*

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Beschreibung des Basismessverfahrens mittels horizontaler Distanzlatte. Von H. Böhler.

Ein bequemeres Rechenverfahren zur Böhlerschen Basismessung. Von Kapitän-Leutnant Kurtz.

Surveying. **Close.**

Text-Book of Topographical and Geographical Surveying. By Major C. F. Close, C.M.G. London: Wyman & Sons, 1905. Size 11 × 7½, pp. vi. and 288. *Maps and Diagrams. Price* 3*s.* 6*d. Presented by the Publishers.* [See reviews, *ante.*]

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Geomorphology. *Science* **21** (1905): 825–828. **Davis.**

Leveling without base-leveling. By Prof. W. M. Davis.

Shows how Dr. Passarge's investigations of African surface features tend towards a modification of current ideas.

Geomorphology. *Le Globe, B.S.G. Genève* **44** (1905): 125–128. **Pittard.**

Contribution à l'étude de la formation des gorges (Action des eaux tourbillonnantes). Communication de M. le prof. Eugène Pittard.

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Ein Gestaltungsprinzip der Erde. II. Von Paul Reibisch. *Maps.*

A further elaboration of the author's theory which seeks to account for the major relief of the Earth's surface by a secular swinging motion of its mass.

Glacial Epoch. *Forh. Vidensk.-S. Christiania* (1904): No. 7, pp. 20. **Øyen.**

Versuch einer glacial geologischen Systematik. Von P. A. Øyen.

Glaciers. **Blümcke and Finsterwalder.**

Sitzber. math.-phys. Klasse K.B.A. W. Munchen (1905): 109–131.

Zeitliche Änderungen in der Geschwindigkeit der Gletscherbewegung. Von A. Blümcke und S. Finsterwalder. *Diagram.*

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The Flow of Glaciers and their Stratification. By Prof. H. F. Reid. *Plates.*

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Les puits qui soufflent et qui aspirent. Par Dr. F. Gerlier.

Phytogeography. **Unwin.**

Future Forest Trees, or the importance of the German experiments in the Introduction of North American Trees. By A. H. Unwin. London: T. Fisher Unwin, 1905. Size 8½ × 5½, pp. 108. *Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

An interesting account of the results of planting, for the sake of their timber, various species of North American trees, which in this country are known chiefly as ornamental trees. In many cases the results have been very encouraging.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *M.V.E. Dresden* (1905): 29–38. **Gravelius.**

Zur Anthropogeographie des Wassers. Von Prof. D. Gravelius. I. Einleitende Bemerkungen.

Commercial. **Brant.**

General Index, arranged in order of Countries and Subjects, to Hertslet's Commercial Treaties, vols. 1 to 21. Compiled by R. W. Brant. Vol. 22. London: Harrison & Sons, [1905]. Size 9 × 5½, pp. vi. and 1282. *Price* 15*s*.

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Die Grossmächte und der Grossverkehr. Von Dr. M. Eckert. *With Map.*

The map shows graphically the relative importance of the great ocean trade-routes.

Commercial. **Kraus.**

Versuch einer Geschichte der Handels- und Wirtschaftsgeographie. Habilitationsschrift zur Erlangung der Venia legendi an der Akademie für Sozial- und Handelswissenchaften vorgelegt von Dr. A. Kraus. Frankfurt a. M.: J. D. Sauerländer, 1905. Size 9½ × 6, pp. viii. and 104. *Price* 2*m*. 40. *Presented by the Publisher.*

Historical. *B.S.G. Italiana* **6** (1905): 64–75. **Enrile.**

Di un atlante nautico disegnato in Messina nel 1596 da Giovanni Oliva e conservato oggi nella Biblioteca del Comune di Palermo. Communicazione del dott. A. Enrile. *With Map.*

Historical. *B.G. Hist. et Descriptive* (1904): 206–222. **Hamy.**

James Cook et Latouche-Tréville. Note sur un projet d'exploration des mers australes (1774–1775). Par le Dr. E. T. Hamy.

Reproduces correspondence relating to the project of a South sea voyage entertained by Latouche.

BIOGRAPHY.

Arrhenius. *Terrestrial Magnetism* **10** (1905): 50. ——

Svante August Arrhenius. *With Portrait.*

Bering. *G. Tidskrift* **6** (1882): 89–98. **Lauridsen.**

Vitus Jonassen Bering. Af P. Lauridsen. *With Map.*

Ratzel. *Riv. G. Italiana* **12** (1905): 8–18, 102–126. **Marinelli.**

Federico Ratzel e la sua opera geografica. Appunti di O. Marinelli.

Rein. *Veröffent. 1 G.V. Bonn* (1905): 1–8. **Kerp.**

Johannes Justus Rein zum 70. Geburtstage. Von H. Kerp. *With Portrait.*

Ricci. *Riv. G. Italiana* **12** (1905): 136–146. **Magnaghi.**

Il P. Matteo Ricci e la sua opera geografica sulla Cina. A. Magnaghi.

Richter. *Riv. G. Italiana* **12** (1905): 226–228. **Gravisi.**

Edoardo Richter.—Cenni biografici. Dott. G. Gravisi.

Richter. **Penck.**

Eduard Richter. Von A. Penck. Wien, 1905. Size 7 × 4½, pp. 10.

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Sophus Ruge. Von Prof. Dr. H. Gravelius.

Saussure. *Le Globe, B.S.G. Genève* **44** (1905): 143–157. **Claparède.**

Henri de Saussure (1829–1905). Par M. Arthur de Claparède. *Portrait.*

Stübel. *Riv. G. Italiana* **12** (1905): 81–91. **D'Ossat.**

Maurizio Alfonso Stübel, i suoi viaggi e la sua teoria dei vulcani. Di G. de Angelis D'Ossat. *With Portrait.*

Tippu Tib. *Deutsche Kolonialzeitung* **22** (1905): 291–292. **Leue.**

Tipputip. Von A. Leue. *Portrait.*

The famous Arab trader has lately died.

Van Langren—Bibliography. **Tiberghien.**

Contribution à la Bibliographie de M.-F. Van Langren. Documents existant à la Bibliothéque Royale de Belgique. Par Alb. Tiberghien. (Extrait de la 'Révue des Bibliotheques et Archives de Belgique,' tome 2.) 1904. Size 9 × 6, pp. 14. *Presented by the Author.*

Describes some of the cartographic productions of Van Langren which have hitherto received little notice.

Wissmann. *Mouvement G.* **22** (1905): cols. 307–309. **[Wauters.]**

Le Major von Wissmann. Par A. J. W. *Portrait.*

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Bibliography. **[Brunner.]**

Catalog der Bibliothek des Schweizer Alpenclub, 1905. Mit Sachregister. Zürich, 1905. Size 9 × 6, pp. 96. *Presented by Mr. H. Brunner.*

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International Catalogue of Scientific Literature. Third Annual Issue. J. Geography, Mathematical and Physical. London: Harrison & Sons, 1905. Size 8½ × 5½, pp. viii. and 360. *Price* 16*s.* 6*d.*

Current Events. **Almeida.**

Chronicas Geographicas. Estudos de actualidade por F. de Almeida. Coimbra: F. Amado, 1905. Size 7½ × 5, pp. xvi. and 254. *Presented by the Author.*

Educational. *The School World* 7 (1905), 100–103. **Simmonds and Richardson.**

Experimental Geography. II. Temperature Observations. By A. T. Simmonds and Hugh Richardson. *Diagrams.*

See note on first part in *Journal*, vol. 25, p. 219.

Educational. *J. of G.* 4 (1905): 145–163. **Tarr and others.**

Results to be expected from a School Course in Geography. By R. S. Tarr, R. H. Whitbeck, M. K. Genthe, and Mark S. W. Jefferson.

French Colonies.

Statistiques Coloniales pour l'Année 1903. Commerce. Melun, 1905. Size 9½ × 6½, pp. lxiv. and 1060.

Travel. **Macdonald.**

In Search of El Dorado, a Wanderer's Experiences. By A. Macdonald. With an Introduction by Admiral Moresby. London: T. Fisher Unwin, 1905. Size 9 × 6, pp. xviii. and 292. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

A record of adventure in the wilds of the Yukon and Australia in search for gold. The letters F.R.G.S. are appended to the author's name, but he is not a member of our Society.

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EUROPE.

Denmark. **Danish General Staff.**

Generalstabens topografiske Kaart over Danmark. Scale 1 : 40,000 or 1·5 inch to a stat. mile. Sheets: Aakirkeby, Christiansö, Gjedser, Nexö, Rönne, Skjelby. Copenhagen: Danish General Staff, 1905. *Presented by the Danish Government.*

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1905.

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45 N.E., S.W., 46 N.W., N.E., S.W., 47 N.W., 48 N.W. **Cardiganshire,** 28 N.E. **Devonshire,** 2 S.W., S.E., 4 S.W., 6 N.W., 8 N.E., S.W., 10 N.W., S.W. **Gloucestershire,** 1 S.W. **Herefordshire,** 9 S.W., 13 N.W., S.W., S.E., 21 N.E., 29 N.W., 42 N.W., 46 S.W. **Lincolnshire,** 95 S.W., 105 N.E., 115 N.W., N.E., 124 N.W., 132 N.E., S.E. **Norfolk,** 102 N.E., 103 S.E., 107 S.W. **Radnorshire,** 21 N.E. **Somerset,** 6 N.E. **Suffolk,** 12 N.E., S.W., 13 N.E., 14 S.E., 17 S.W., 18 S.E., 19 S.W., 26 N.E., 27 N.E., 32 N.W., 33 N.W. **Warwickshire,** 14 N.W., 24 S.W., 25 N.W., N.E., 26 N.W., 31 N.W., 33 N.W., 36 N.E., S.E., 43 S.W., 48 N.E. **Worcestershire,** 17 S.W., 24 N.W., 30 N.E., S.E., 36 S.W., 40 S.W., 42 N.E. **Yorkshire** (first revision of 1891 survey), CCLXXVIA., N.E., CCXCIII., N.W., N.E. (S.W. and S.E. and CCXCVIIIA., N.E.), CCXCV., S.E. 1*s. each.*

25-inch—County Maps (first revision):—

Cardiganshire, XXIII. 16; XXVI. 16; XXXI. 16; XXXII. 5, 9; XXXIII. 14, 15; XXXV. 9; XXXIX. 6, 10, 11, 12; XL. 2, 3, 4, 6, 7, 8, 9, 10, 12; XLI. 1, 2, 3, 5, 6, 7, 9, 10. **Carmarthenshire,** II. 9; VII. 3, 7, 10. **Devonshire,** XVII. 6, 10, 11, 12; XVIII. 9; XXV. 16; XXXV. 4; XLVIII. 15; LV. 13; LIX. 3, 4, 7, 8; LX. 1, 2, 5, 6, 9, 10, 13, 14, 15, 16; LXA. 13; LXXII. 2, 3, 4, 6, 7, 8, 11, 15; LXXIIA. 1; LXXXIX. 12; XC. 13; XCI. 13, 14, 15; XCII. 13, 14, 15, 16; XCIII. 13, 14; XCIX. 7; C. 1, 5, 9, 12, 13, 14, 15, 16; CI. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16; CII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; CIII. 1, 3, 5, 6, 7; CIX. 2, 3, 6, 7, 10; CX. 2, 4, 15. 3*s. each.* XXV. 15; XLVIIIA. 13, 14; LX. 11. 1*s.* 6*d. each.* **Lincolnshire,** LXXXVII. 5, 11, 16; LXXXVIII. 2, 3, 4, 5, 6, 8, 10, 11, 13, 14, 15, 16; LXXXIX. 1, 2, 4, 7; XC. 3, 4, 5, 6, 7, 8, 9; CI. 1, 2, 3, 4, 5, 6; CIX. 14; **Norfolk,** XLV. 9, 15; XLVI. 7; XLVII. 1, 2, 3, 5, 7, 9, 10, 11, 13, 14, 15; LIX. 10, 14; LXVIII. 2, 6, 10, 14; LXX. 4; LXXI. 1, 2, 3; LXXX. 2, 6, 11, 12; LXXXIX. 3, 7, 8, 11, 15, 16; XC. 14; XCIX. 2, 3, 4; C. 1, 2. **Suffolk,** III. 8; IV. 6, 7, 8, 10, 11, 12, 14, 15, 16; X. 2, 3, 7, 11. **Warwickshire,** XL. 7, 8, 14, 15; XLI. 4, 7, 10, 13; XLIII. 12, 16; XLIV. 1, 2, 3, 6, 8, 9, 10, 11, 12, 14, 15, 16; XLV. 7, 8, 14, 16; XLVI. 1, 6, 7, 10, 11, 12, 13, 14; XLVII. 1, 2; LI. 1, 3, 4, 8, 11, 12, 14, 15, 16; LII. 1, 2, 3, 5, 6, 12; LIV. 3, 7, 10, 11, 14, 15; LV. 1, 3; LVII. 2, 3, 9, 10, 13. **Yorkshire** (First Revision of 1891 Survey), CCLXXXVIII. 14; CCLXXXIX. 14. 3*s. each.*

England and Wales. **Geological Survey.**

1-inch—New Series (colour printed):—

141, Loughborough; 282, Devizes; 299, Winchester. Drift edition. 1*s.* 6*d. each.*

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Brecknockshire, 43 N.W., N.E., S.E., 44 S.W. **Carmarthenshire,** 49 S.E., 50 N.W. **Derbyshire,** 57 S.W., 60 N.W., N.E., S.E., 61 N.W. **Glamorganshire,** 2 S.E., 3 N.W., S.E., 4 S.W., 8 S.W., 9 N.W., N.E., S.W., S.E., 15 N.W., N.E., S.E., 34 N.W., N.E. **Leicestershire,** 15 N.E., S.E., 16 N.W., S.W., S.E., 22 S.E., 23 N.E., S.W., S.E., 29 N.E., 31 N.W., N.E., S.E., 37 N.E. **Staffordshire,** 41 S.W., 47*a* N.W. 1*s.* 6*d. each.*

(*E. Stanford, London Agent.*)

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Karographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: (brown hills and contours) 313, Oschersleben; (plain) 318, Zossen. Berlin, 1905. *Price* 1.50 *mark each sheet.*

Germany. **Polis.**

Regenverteilung am 17 Juni 1904 im Maas-, Rhein- und Wesergebiet entworfen von P. Polis. Scale 1 : 1,250,000 or 19·7 stat. miles to an inch.—Gewitterverteilung am 17. Juni 1904 im Maas- und Rheingebiet entworfen von P. Polis. Scale 1 : 1,250,000 or 19·7 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang 1905, Taf. 15. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

London. **Stanford.**

Stanford's New Map of the County of London. Scale 1 : 15,840 or 4 inches to a stat. mile. 20 sheets. London: Edward Stanford, 1905. *Price, in sheets,* 15*s. Presented by the Publisher.*

Owing to recent important changes, it has become necessary to publish a new edition of this excellent map of London, and it is evident that the work of revision has been well done. The map extends to Barking and Cross Ness on the east, and includes the whole of the extra metropolitan borough of West Ham; on the west it embraces part of the borough of Ealing, the whole of the borough of Richmond, and the greater part of the borough of Kingston; on the north, part of the borough of

Hornsey; and on the south, the borough of Wimbledon and the hamlet of Penge, with the northern verge of Croydon. Altitudes in feet are given at frequent intervals, and the map is carefully printed in colours.

Montenegro. **Hassert.**

Tiefenkarten montenegrinischer Seen, aufgenommen im Jahre 1900. Von Kurt Hassert. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Taf. 16. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Portugal. **Serviço do Estado Maior.**

Carta dos Arredores de Lisboa. Scale 1 : 20,000 or 3·2 inches to a stat. mile. Sheets: 8, 62, 63, 65, 67, 68, 71, 72, 73, 76, 77, 78, 80, 81, 82. Lisbon: Serviço do Estado Maior, 1903–1905.

ASIA.

Asia. **Philip.**

Philip's Comparative Series of Large Schoolroom Maps. Asia. Scale 1 : 6,000,000 or 94·7 stat. miles to an inch. London: George Philip & Son. *Price* 18*s.* *Presented by the Publisher.*

This large wall-map measures about 6½ × 5½ feet, and is drawn and printed in a bold style. In keeping with the rest of the series, it is orographically coloured, the lower lands being in two tints of green, and the higher three shades of brown. The mountain ranges are also shown by the ordinary shading beneath the orographical tinting. Instead of making use of two colours, it would have been preferable to have used only shades of brown. A small inset shows political divisions.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Bearbeitet von Dr. Richard Kiepert. Scale 1: 400,000 or 6·3 stat. miles to an inch. Sheet C. i., Smyrna. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Price* 6 *marks.*

In addition to Smyrna and the country immediately to the south and south-east, this sheet includes the islands of Chios, Samos, Nicaria, Patmos, and others in the neighbourhood.

China. **K. Preuss. Landesaufnahme.**

Karte von Ost.-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Canton. Berlin: Kartographische Abteilung der K. Preuss. Landesaufnahme, 1905. *Price* 1.50 *mark each sheet.*

Indian Government Surveys. **Surveyor-General of India.**

Indian and adjacent countries. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 71, parts of Nepal and Tibet; 78, parts of Nepal, Sikkim, Tibet, Bhutan, Bengal, and Assam; 83 and 84, parts of Bengal, Assam, and Burma; 91, parts of Assam, Tibet, and China (Yunnan and Se-chuan Provinces); 93, parts of Burma, China, and Siam; 101, part of China (Yunnan, Se-chuan, and Kweichou Provinces); 102, parts of Burma, Siam, Tongking, and China (Yunnan Province), 1903–4.—Northern Frontier, 4 miles to an inch. Sheets: 9 N.E., 8 W., S.E., 15 N.E., 21 S.W., 22 N.W., N.E., S.E. Tibet, Season 1904–5.—North-Eastern Frontier, 4 miles to an inch. Sheets: 6 N.W., N.E., S.W., S.E., 7 N.W., Tibet, Season 1904–5. Calcutta: Survey of India Office. *Presented by the Surveyor-General of India.*

AFRICA.

Rhodesia, North-East. **Topographical Section, General Staff.**

North-east Rhodesia. Scale 1 : 2,000,000 or 31·6 stat. miles to an inch. London: Topographical Section, General Staff, War Office, 1905. *Price* 2*s.* *Presented by the Director of Military Operations.*

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von P. Sprigade. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheet C 2, Sokodé. Berlin: Dietrich Reimer (Ernst Vohsen), 1905. *Presented by Herr P. Sprigade.*

AMERICA.

Argentine Republic—Cordoba. **Río and Achával.**

Geografía de la Provincia de Córdoba, por Manuel E. Río y Luis Achával. Atlas. Buenos Aires: Compañía Sud-Americana de Billetes de Banco, 1905. *Presented by the Publisher.*

This large atlas contains altogether nine sheets of maps and sections and six sheets

of illustrations. First is a general map of the province of Córdoba, next a hypsometrical map of the province showing zones of attitude from 76 to 2880 metres in different colours, followed by numerous vertical sections across the province. Then there are maps illustrating the hydrography and river systems, the geology, plant distribution, climate and means of communication. Of the illustrations, two sheets show varieties of plant life, while the others are of a general, industrial and agricultural nature. The atlas is published under the direction of the governor of the Córdoba, and if the maps are not all excellent specimens of cartography, the information contained is valuable.

Canada. **Department of the Interior.**

Map of Manitoba, Saskatchewan, and Alberta. Scale 1 : 792,000 or 12·5 stat. miles to an inch. Special edition showing even-numbered sections finally disposed of. Corrected to May 1, 1905. Prepared under the direction of R. E. Young, D.L.S., Superintendent of Railway and Swamp Lands. 3 sheets. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Canada. **Department of the Interior.**

Standard Topographical Map of Canada. Scale 1 : 500,000 or 7·9 stat. miles to an inch. Sheet 13, New Brunswick, St. John. Ottawa: Department of the Interior, 1905. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Canada. **Surveyor-General of Canada.**

Sectional map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Yale Sheet (11), West of Sixth Meridian, revised to August 10, 1905; Sicamous Sheet (112), West of Sixth Meridian, revised to August 10, 1905; Touchwood Sheet (169), West of Second Meridian, revised to August 18, 1905; Nut Mountain Sheet (169), West of Second Meridian, revised to August 18, 1905. Ottawa: Department of the Interior, 1905. *Presented by the Department of the Interior, Ottawa.*

Chile—Argentine Boundary. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: Coquimbo-Aconcagua; Aconcagua; Aconcagua;—Santiago; O'Higgins-Colchagua; Llanquihue. Santiago: Oficina de Limites, [1905]. *Presented by the Oficina de Limites, Santiago.*

This important map shows the general cartographical results of the surveys of the Chilian Boundary Commission along the main range of the Andes from lat. 31° to 35° S., and from 42° to 43° S. There are altogether five sheets, each of which includes a degree of latitude and about a degree of longitude. Two editions of each sheet have been published, one showing the traverses and triangulation upon which the map is based, and the other the topographical features. As explained by Dr. Steffen in a paper read before our Society, owing to the nature of the country it was found more convenient to carry on the survey by a series of polygonal traverses combined with triangulation, than by a regular system of triangulation alone, and this arrangement is clearly shown on the sheets. The sheet containing Aconcagua is worthy of special attention, and it is interesting to note that the height of this peak is given as 6960 metres (or 22,835 feet) instead of 23,080 feet as shown in Mr. Fitzgerald's map in the *Geographical Journal* for November, 1898. Both Mr. Fitzgerald and Mr. Vines, who accompanied him, gave special attention and care to the fixing of the height of this peak. This Aconcagua sheet might have been rendered more complete as regards topographical detail if better use had been made of the surveys of Messrs. Fitzgerald and Vines. The international boundary, as determined by the recent arbitration, is laid down on the map in red.

North America. **Bartholomew.**

Reduced Survey Map of the United States and part of Canada, by J. G. Bartholomew, F.R.G.S. Scale 1 : 5,000,000 or 79 stat. miles to an inch. Edinburgh: John Bartholomew & Co., [1905]. *Price, mounted on cloth, 3s. net. Presented by the Publisher.*

A good and clearly drawn general map of the United States and the greater part of the Dominion of Canada, with eight inset plans of cities and towns. Only an indication of mountain ranges is given by form lines, with heights of peaks in figures, and consequently the names on the map, even in the more crowded parts, can be read with the greatest ease. This system is far preferable in a map of this character to attempting a great deal of shading, which only tends to obscure the lettering.

CHARTS.

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Charts. Nos.: 109, Magallanes. Canal Fitz-Roy; 112, Magallanes, Puertos en el Golfo Xaultegua; (Provisional) 122, Seno Ultima Esperanza, Canal Señoret i Estero Eberhardt. Valparaiso: Oficina Hidrografica, Marine de Chile, 1905. *Presented by the Chilian Hydrographic Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for September and October, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for September and October, 1905. London: Meteorological Office, 1905. *Price* 6*d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for October, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

Russian Charts. **Chief Hydrographic Department, St. Petersburg.**

No.

655 Plan of Dickson Island and anchorage. Siberia. Scale 3500 feet to an inch. 1905.

659 Chart of Shuya River entrance and Shuya River to Shuya village. White Sea. Scale 1750 feet to an inch. 1905.

Presented by the Chief Hydrographic Department, Ministry of Marine, St. Petersburg.

PHOTOGRAPHS.

Arabia.

Four photographs of Mecca. *Presented by Lieut.-Colonel F. R. Maunsell, C.M.G., R.A.*

These photographs are of more than ordinary interest, and the fourth—a good general view of the city—is perhaps unique.

(1) Praying round the Kaaba, Mecca; (2) Closer view of the Kaaba; (3) Scene round Mount Arafat; (4) General view of Mecca and the Central Mosque.

Bahr-el-Ghazal. **Talbot.**

Eighteen photographs of the Bahr-el-Ghazal Region, taken by Colonel Hon. M. G. Talbot, R.E., C.M.G. *Presented by Colonel Hon. M. G. Talbot, R.E., C.M.G.*

The following are the titles of this interesting little typical set of photographs:—

(1) View near Kiro; (2) Officers at Kiro; (3) Kiro mess-house; (4) Director of Public Works at Dem Temma, near Fashoda; (5) Nassr. Audal, Sultan of Talgaona; (6) Golo girls; (7) Golo woman; (8) Woman travelling at the Bahr-el-Ghazal; (9) Store-house at Chak-Chak; (10) A Dinka hut near Chak-Chak; (11) Mess-house at Lado; (12) Kenissa; (13) Government house, Wau; (14) The Biri river; (15) View near Gondokoro; (16) A Bongo warrior; (17) Om Doku people; (18) One of Tambura's men.

Baltistan. **Duncan.**

Six photographs of Rock Carvings in the Indus and Shayok Valleys, taken by Miss Duncan. *Presented by Miss Duncan.*

These photographs were taken by Miss Duncan during her visit in the summer of 1904. The carvings are rough representations of animals, men, the human hand, and various other figures, together with hieroglyphics and writing, which, up to the present time, have not been deciphered, but which are supposed to date back at least five hundred years.

(1–5) Carvings on a rock in the Shayok Valley, near Kuness; (6) Carvings on rocks near Dumkar.

Nile Sudd. **Drury.**

Sixteen photographs of the Nile Sudd, taken by W. B. Drury, Esq. *Presented by W. B. Drury, Esq.*

A good idea of the enormous accumulation of sudd in the tributaries of the upper Nile can be obtained from these photographs, some of which, such as Nos. 1 and 2, are

decidedly typical. Mr. Drury has had considerable experience of sudd clearing, having spent two years at the work. The titles are as follows:—

(1 and 2) Clearing the Bahr Jur; (3) Belgian commandant's house, Lado; (4) Bringing in fuel, Kenissa; (5) The bank of the Bahr-el-Jebel; (6) A camp at No. 19 block, Bahr-el-Jebel; (7) A detached piece of sudd being towed away, Bahr-el-Jebel; (8) Block No. 19, as it appeared before starting work; (9) Finishing off No. 16 block, Bahr-el-Jebel; (10) Island, Bahr Jur; (11) Pulling the sudd out of the centre of the channel; (12) Camp at the Bahr-el-Arab; (13) A village on the upper Nile; (14) Meat for the prisoners; (15 and 16) The Ripon falls.

Rhodesia. **Wallace.**

One hundred and sixty-three photographs of North-East Rhodesia and the Zambezi River, taken by L. A. Wallace, Esq. *Presented by L. A. Wallace, Esq.*

A most excellent series of photographs remarkably well taken and typical of the country. Many are enlargements, and these are specially effective. Mr. Wallace has had many years' experience of this part of Africa, during which he has evidently made good use of his opportunities of photography. The following are the titles:—

(1 and 2) Lake Chila, Abercorn; (3) View on Tanganyika plateau; (4 and 5) View from Ilonda hill, Tanganyika; (6) View from Zumbe hill; (7) Mwaruli, the burying-place of Awemba chiefs; (8 and 9) South end of Lake Tanganyika; (10) Muchinga mountains, near Mirongo; (11) Strata of the Muchinga mountains; (12) Temporary village, Tanganyika plateau; (13) Lubu river, near Chambezi; (14) Chunanabuwi stream, Muchinga mountains; (15) Kachinga stream, Muchinga mountains; (16) A stagnant pool on Tanganyika plateau; (17) View from Muchinga mountains down Nkanka stream, near Mirongo; (18) Mwambwa river; (19) Lufira river; (20) Luangwa river; (21) Hot springs, Nawalia; (22) Granite hill; (23) View from Granite hill; (24 and 25) The lower Zambezi; (26) The Zambezi near Boroma; (27) Tete from left bank of Zambezi; (28) Luiya river; (29) In Kabrabasa rapids, Zambezi river; (30) Top of Granite hill; (31 and 32) Kafue river; (33) Lake near Kafue river; (34) Chirangwa; (35 and 36) Upper Kafue river; (37 and 38) Near Chongolos on the Luapula river; (39 and 40) South end of Lake Bangweulu; (41) Dry stream-bed at Mlilo's, upper Luangwa valley; (42) Mlilo's village; (43) Baobab tree, Luangwa valley; (44) Village, upper Luangwa; (45 and 46) In upper Luangwa valley; (47) Limestone bed, Luumbu river; (48–51) Luumbu river; (52) View across the Luumbu valley; (53 and 54) Dry bush in Luumbu valley; (55) Spirit house at village; (56) Enclosed village, Luangwa valley; (57) Mambwe river; (58 and 59) Stream to Luangwa; (60, 62, and 63) Luangwa river; (61) Hot pool, Luangwa; (64) Making camp; (65) Granite hill; (66) Near top of Granite hill; (67 and 69) Granite hill; (68) Road through bamboo jungle; (70 and 71) Granite hill on Tete road; (72, 73, 76, 77, 110, and 111) Road from Fort Jameson to Tete; (74) Mount Chipiri; (75) Mount Chuuta; (78 and 79) Granite summit of Manji mount; (80–85) Kabrabasa rapids, Zambezi river; (86) Near foot of Kabrabasa rapids; (87 and 88) Kachimadzi stream; (89) Granite rock on Tete road; (90) Wart hog; (91–99) Luangwa river; (100) Mount Tendi in distance; (101) Chipawa station; (102–104) Upper Kafue river; (105–107) Forest on limestone, Kafue valley; (108) Suseufwa river; (109) Granite hill; (112) Making road; (113) Luapula flats near Chongolos; (114–116) Ferry at south end of Lake Bangweulu; (117–119) Swamp near Luapula; (120–122) South bank of Lake Bangweulu; (123) Kafue river plain; (124, 130, and 131) Making rush mats; (125 and 126) A cold morning; (127) Village, showing hut and grain store; (128) Resting at a village; (129) A quiet village; (132 and 133) Caravan resting at a village; (134 and 135) A game of cards; (136) Bargaining for flour; (137) Filling a goatskin with flour just bought; (138–141) Natives at water-hole in very dry country; (142 and 143) On the Tete—Fort Jameson road; (144) View near Msadzu river; (145) In the dry Luangwa valley; (146–149) On Lake Bangweulu; (150 and 151) Near the foot of the Kabrabasa rapids, Zambezi river; (152) Travelling down the Luangwa; (153) On the march; (154 and 155) Dead hippopotamus; (156) Treeless forest in the Luangwa valley; (157) Lake Chila, Abercorn; (158 and 159) Lukusya river; (160) Chimanabui river; (161) Zambezi river above Tete; (162 and 163) Luangwa river

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

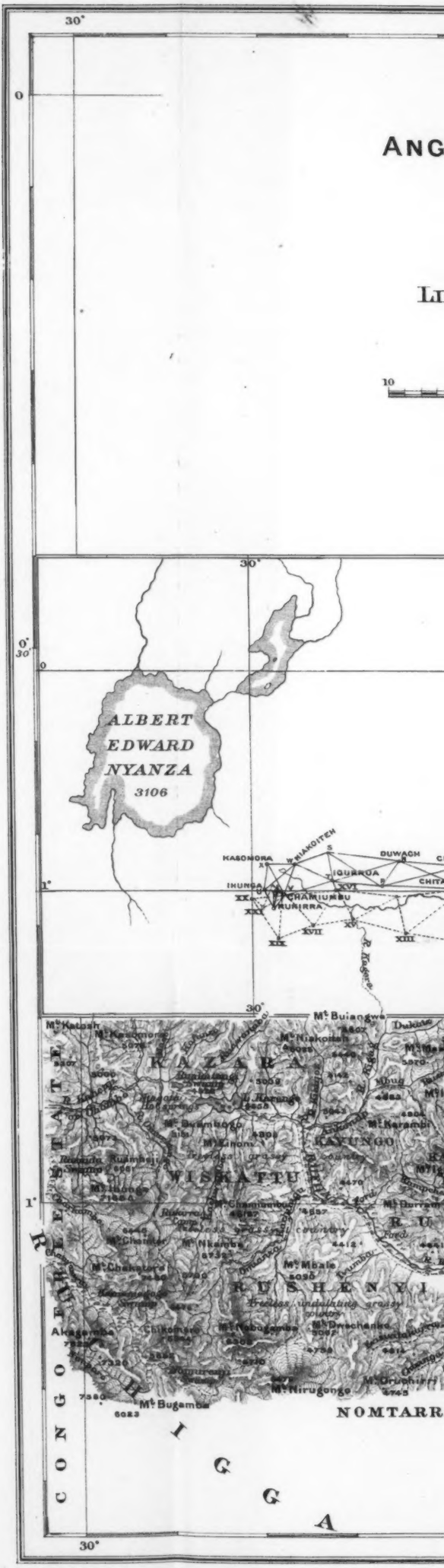
Latitudes and Longitudes of Points connected with the work of the Anglo-German Boundary Commission, Uganda.

Main Triangulation Stations between Port Florence & Mizinda.

Station.	Latitude.				Longitude.			
Port Florence	0°	06′	06.04	South.	34°	44′	49.15	East.
Maragul ..	0	00	22.46	,,	34	39	38.86	,,
Rari	0	07	35.81	,,	34	36	32.94	,,
Maréwa ..	0	03	13.68	,,	34	32	49.59	,,
Ndere ..	0	12	18.98	,,	34	30	28.64	,,
Buga ..	0	14	06.34	,,	34	22	56.01	,,
Rambugu ..	0	06	00.11	,,	34	21	40.59	,,
Abiru ..	0	10	43.81	,,	34	14	56.50	,,
Usiri ..	0	03	54.12	,,	34	13	16.38	,,
Obambo ..	0	03	21.82	North.	34	12	04.11	,,
Sérawongo ..	0	09	32.47	South.	34	08	11.68	,,
Wanga ..	0	08	08.72	North.	34	04	22.80	,,
Ramogi ..	0	00	30.17	South.	34	02	59.86	,,
Misoma ..	0	12	42.25	North.	34	02	36.19	,,
Namenya ..	0	05	23.84	,,	33	58	02.95	,,
Siavona ..	0	14	28.57	,,	33	51	17.02	,,
Nampongwe .	0	06	05.34	,,	33	46	06.65	,,
Bumeru ..	0	11	22.69	,,	33	43	01.62	,,
Vumba ..	0	01	59.90	,,	33	38	49.50	,,
Dagusi ..	0	07	51.29	,,	33	34	53.11	,,
Luvia ..	0	02	35.53	,,	33	28	32.31	,,
Marongo ..	0	13	15.69	,,	33	27	06.89	,,
Bagete ..	0	09	02.88	,,	33	17	01.87	,,
Bugaia ..	0	01	54.88	,,	33	16	01.33	,,
Mwama ..	0	03	29.04	South.	33	08	16.48	,,
Wema ..	0	05	10.86	North	33	05	46.83	,,
Mtunda ..	0	05	08.68	,,	32	55	11.46	,,
Kome ..	0	05	17.77	South.	32	48	13.09	,,
Mbazi ..	0	06	34.47	North.	32	40	59.79	,,
Nsadzi ..	0	05	38.20	South.	32	36	19.78	,,
Entebbe ..	0	03	58.02	North.	32	27	48.32	,,
Bomangi ..	0	19	05.49	South.	32	14	02.36	,,
Sesse II. ..	0	30	28.56	,,	32	08	47.28	,,
Tegetwe ..	0	03	21.32	North.	38	06	45.69	,,
Kasaka ..	0	23	04.50	South.	31	50	16.64	,,
Dumo ..	0	38	50.56	,,	31	47	47.16	,,
Mizinda (III.)	0	58	29.89	,,	31	46	42.15	,,
Kigarama ..	1	02	19.10	,,	31	45	27.31	,,
Mkuki ..	0	27	29.74	,,	31	45	10.25	,,
Bugera ..	0	56	07.83	,,	31	42	33.40	,,
Zirizi ..	0	41	21.72	,,	31	41	33.59	,,
Ulembe ..	1	01	20.07	,,	31	37	18.99	,,
Minziro ..	0	58	39.65	,,	31	33	30.90	,,
Simba ..	0	51	15.92	,,	31	30	48.91	,,

Main Triangulation Stations between Mizinda and Ihunga.

Station.	Latitude.				Longitude.			
Mizinda III.	0°	58′	29.89	South.	31°	46′	42.15	East.
I.	0	57	19.70	,,	31	45	35.37	,,
Kigarama V.	1	02	19.09	,,	31	45	27.29	,,
II.	0	58	22.56	,,	31	45	07.05	,,
Bugera IV. ..	0	56	07.81	,,	31	42	33.40	,,
Ulembe VI.[1]	1	01	20.02	,,	31	37	18.97	,,
Minziro A. ..	0	58	39.58	,,	31	33	30.90	,,
Simba S_3 ..	0	54	10.07	,,	31	17	33.88	,,
E ..	0	54	10.07	,,	31	17	33.88	,,
D ..	0	59	51.87	,,	31	16	49.67	,,
H ..	0	59	28.12	,,	30	57	53.24	,,
I ..	0	52	03.15	,,	30	57	29.11	,,
N ..	0	50	44.27	,,	30	38	53.36	,,
P ..	0	58	06.39	,,	30	34	48.78	,,
T ..	0	57	27.17	,,	30	21	54.69	,,
S ..	0	47	59.33	,,	30	20	14.78	,,
W ..	0	51	24.82	,,	30	11	19.13	,,
V ..	1	00	18.43	,,	30	08	20.94	,,
X ..	0	51	07.84	,,	30	03	51.04	,,
U ..	0	59	46.22	,,	30	02	32.82	,,



30°30′ 31°

Surveys of the
NGLO-GERMAN BOUNDARY COMMISSION
on the
South West Frontier of
UGANDA.

By

LIEUT-COLONEL C. DELMÉ-RADCLIFFE, M.V.O.

1902-1904.

Scale of Miles.

5 0 10 20 30

Nat. Scale 1 : 500,000 or 7·889 miles = 1 inch.

Heights in feet above sea level.

31° 32° 33° 34°

VICTORIA NYANZA

3726

CHART OF TRIANGULATION.

from Port Florence through Mizinda to Ihung

Scale 1 : 2,500,000

10 5 0 10 20 30 40 50 Miles

The German Triangulation is shown in dotted lines.

31° 33° 34°

K A R A

30°30′ 31°

Published by the Royal Geographical Society.

UGANDA PROTECTORATE
Scale of Miles.
10 0 10 20 30 40 50 100
Nat. Scale 1: 4,000,000 or 63·12 miles = 1 inch.
Note: For detailed map of Colonel Delmé-Radcliffe's surveys in the Nile Province see "Geographical Journal" Vol. XXI, p. 220.
31°30'
30
31
32
Kero
Lado
R. NILE
Gondokoro
Rejaf
Mt. Rejaf
Mt. Belinian
Mt. Berkeley
Redden Rapids
R. Gamero
New Dufile
Mt. Elengue
Mt. Ogudi
Old Dufile
Afiddu
Lamogi
Old Wadelai
Wadelai
Pajeo
Mt. Magungu
Foweira
ALBERT NYANZA
2170
Kiberol
Mruli
UNYORO
R. Kafu
R. Ngusse
R. Kimuliro
R. Semliki
R. Nissi
L. Isalt
L. Ruisamba
ALBERT EDWARD NYANZA
3106
ANKOLE
R. Rumesi
L. Kachira
L. Wilhere
L. Mwange
Kazara
Bumpamba
Bukanga
Koki
Mimiode
Kisiba
KARAGWE
Mt. Kasogasoga
Mt. Kama
Mt. Namagoi
Mt. Akakoro
Mt. Kyrima
Mt. Ogwangara
Mt. Dugwauru
Mt. Elizabetzroka
Mt. Lilansimi
Mt. Kiganga
Mt. Simba
Bugommera
Lukoma
Rabbara
R. Jemolubura
Mt. Chusisaseka
Mt. Kisaimbbi
Mt. Yenjera
Mt. Buhunga
Mt. Kasyoroyo
Mt. Kayebbi
Mt. Muyaue
Mt. Ngando
Mt. Kagera
Mt. Ruagelle
Grassy Plain
Swampy
Chukomo
3942
Kakenya
Lukomma
Buvale
Kanyandu
Dwakarisa
Missenyi
R. KAGERA
Kayumbero
(German Post)
G
W
31°30'

33
34
35
0
5
4
3
2
0° 30'
1
1°
RUDOLF PROVINCE
NILE
PROVINCE
KARAMOJO
CENTRAL PROVINCE
LAKE KIOGA
3120'
SABE
Mt ELGON
14,200
L. Salisbury
L. Gedge
L. Normanby
L. Mpologoma
Owen Falls
Ripon Falls
Entebbe
Bugala
Buvuma I.
Kampala
Kisumu
Fort Florence
Kavirondo Bay
Sesse Is.
VICTORIA NYANZA
3726
Mori B.
Bukora R.
Chiasimbe Pt.
Msozi
Lusana
Bukora
Ntonjo
Mt Elgon
Mt Kobbe
Mt Butiere
Busungwe I.
Mizinda
Buhalu Pt.
Kagogo Bay
Luanyega Bay
Lubogo Bay
Buganda
Kisiba

SOUTH AMERICA
MAGELLAN STRAIT
TIERRA DEL FUEGO
Beagle Ch.
Magnano Chan.
Navarin I.
Staten I.
Hoste I.
C. Horn
ANTARCTIC OCEAN
Livingstone I.
Smith I.
Trinity I.
Brabant I.
Antwerp I.
Gerlache Str.
Graham Land
Biscoe Is.
Jason I.
Adelaide I.
Alexander I L.d
Scale of Miles
100 50 0 100
Nat. scale 1:12.500.000
Antarctic Circle
President Loubet's Promontory
Adelaide I.
ALEXANDER I LAND
Coast
70
68

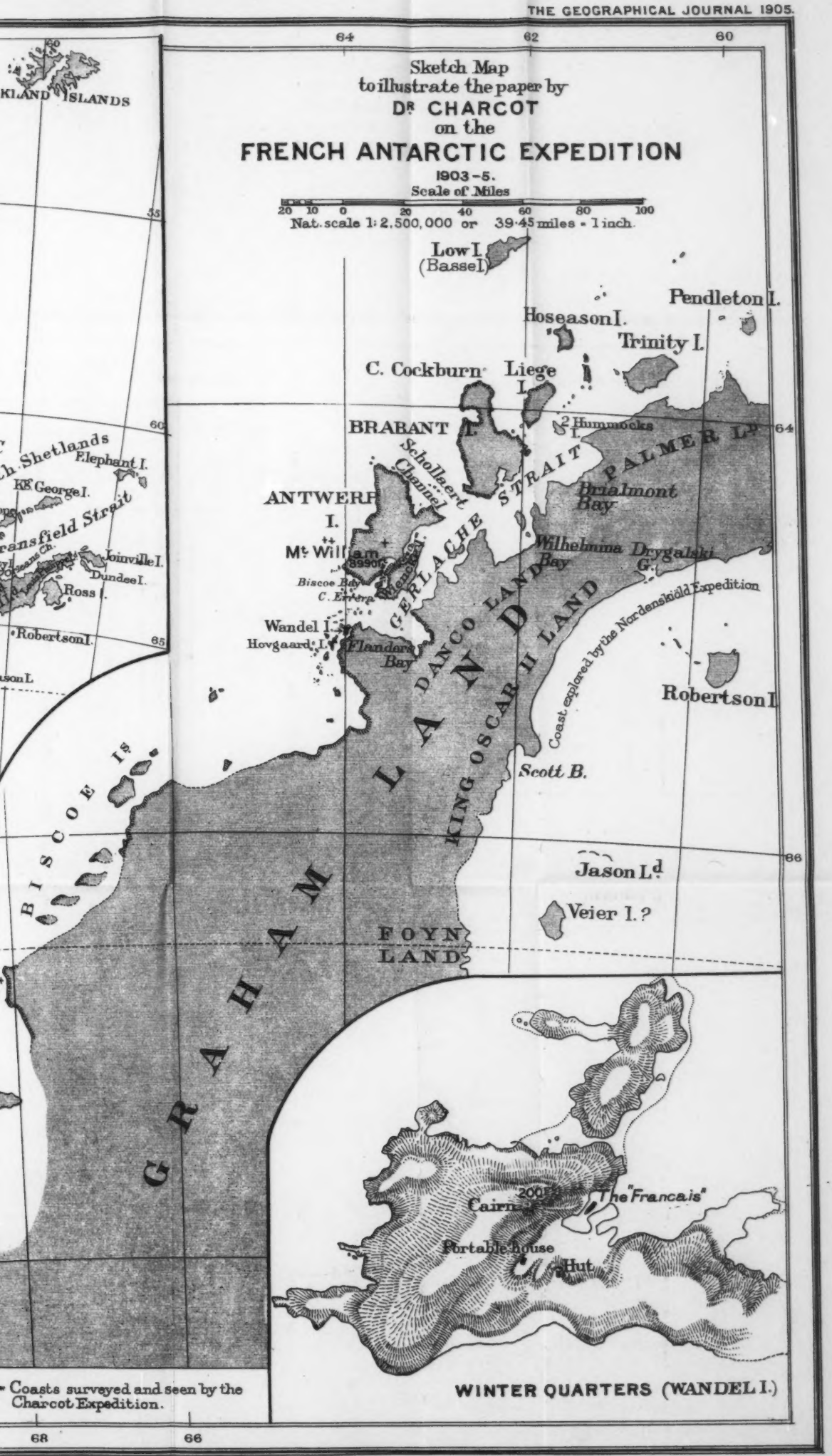


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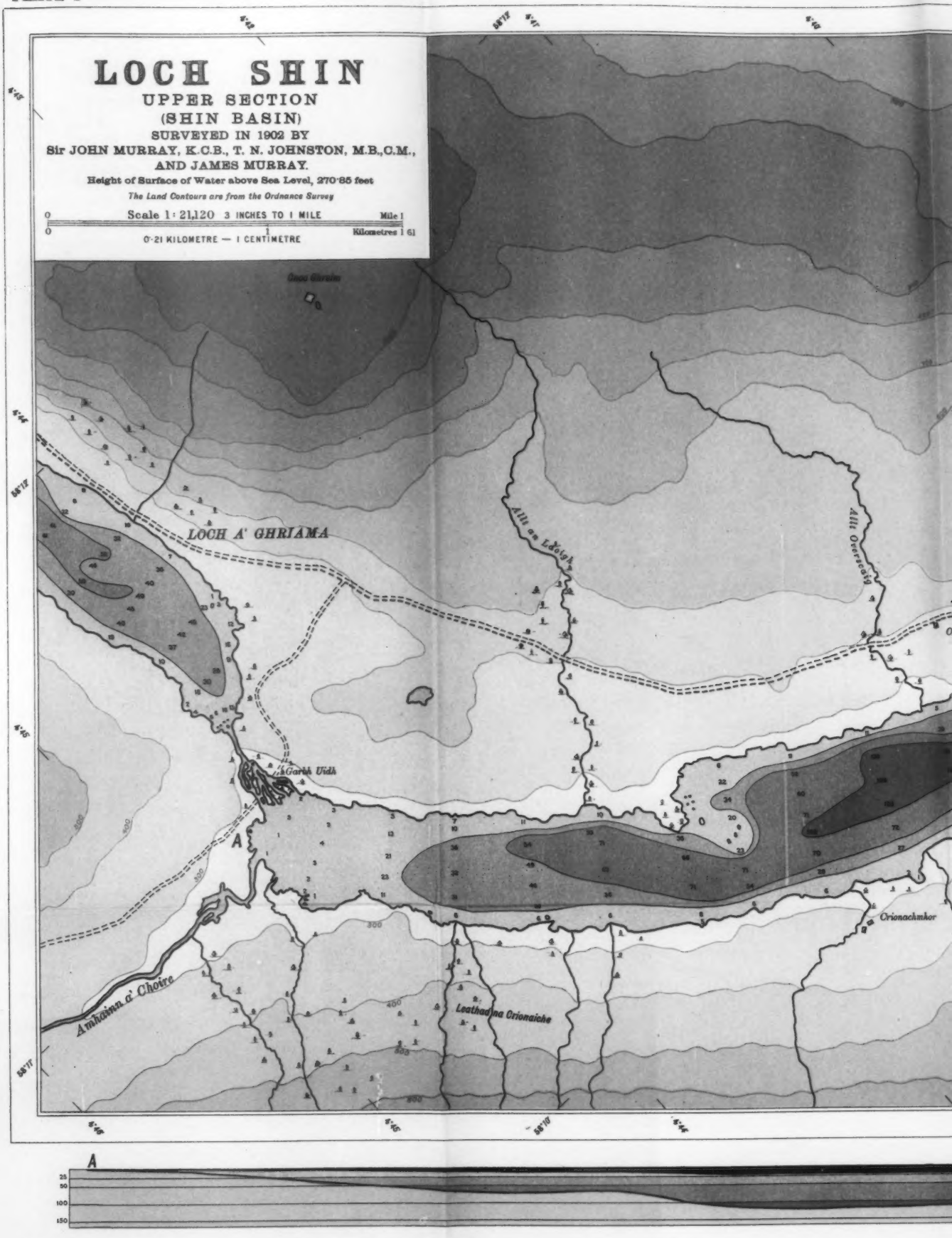
PLATE I

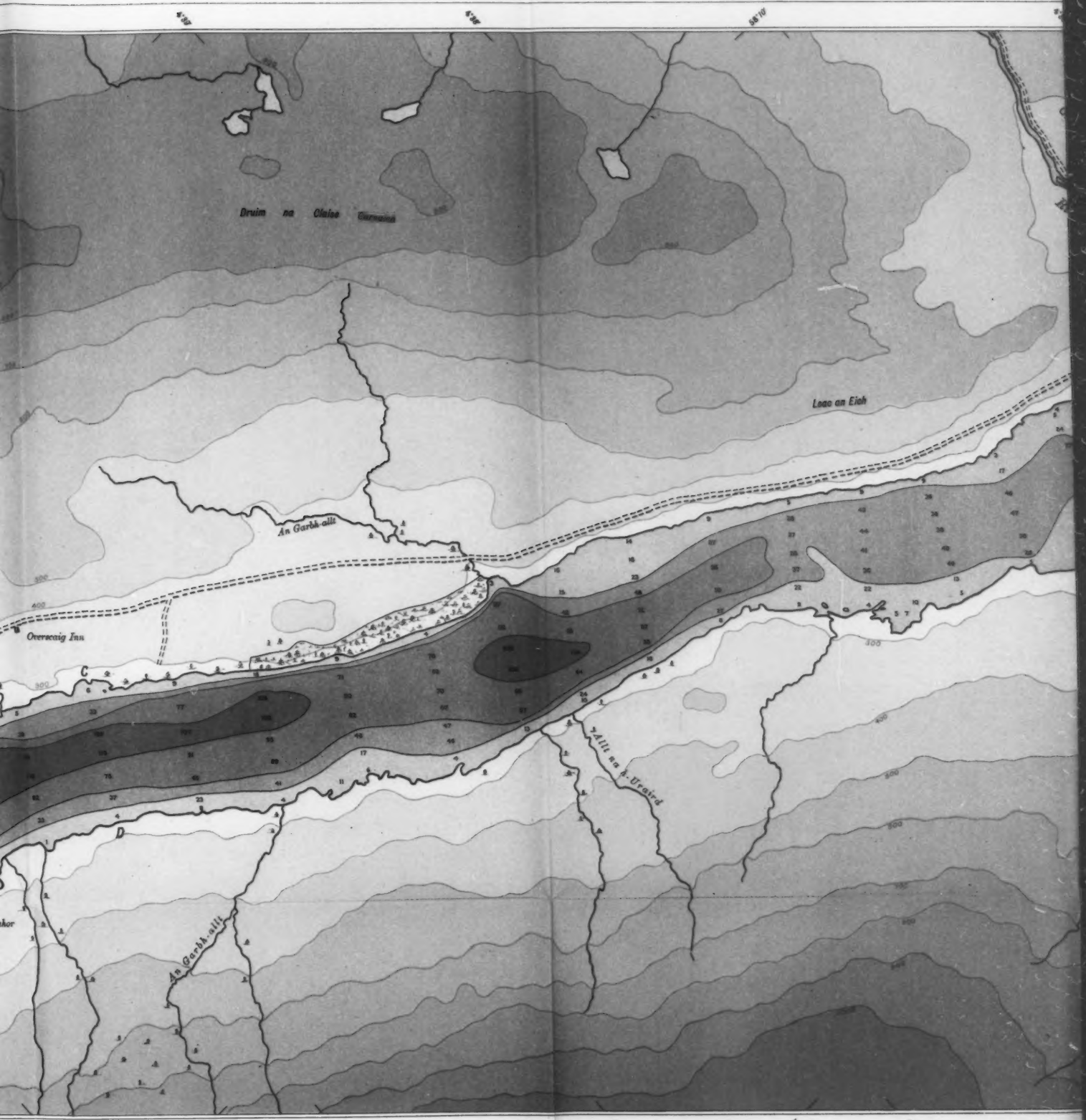

LOCH SHIN
UPPER SECTION
(SHIN BASIN)
SURVEYED IN 1902 BY
Sir JOHN MURRAY, K.C.B., T. N. JOHNSTON, M.B., C.M.,
AND JAMES MURRAY.
Height of Surface of Water above Sea Level, 270·85 feet
The Land Contours are from the Ordnance Survey
Scale 1 : 21,120 3 INCHES TO 1 MILE Mile 1
0·21 KILOMETRE — 1 CENTIMETRE Kilometres 1 61
LOCH A' GHRIAMA
Allt an Lòdaigh
Allt Osreccaig
Garbh Uidh
Amhainn a' Choire
Leathad na Orionaiche
Orionachmhor
A

The Edinburgh Geographical Institute

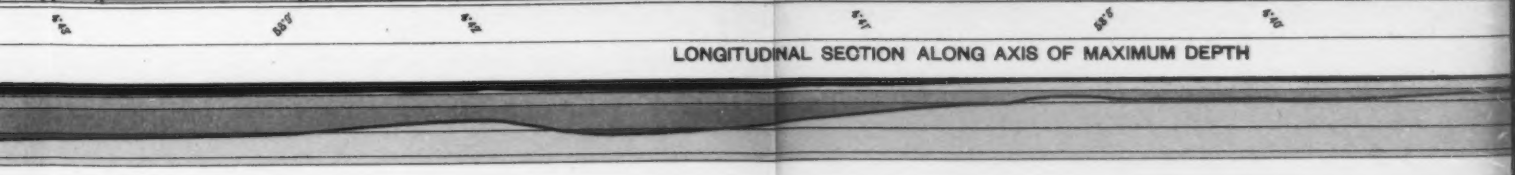
Bathymetrical Survey of the Fresh-water Lochs of Scot

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



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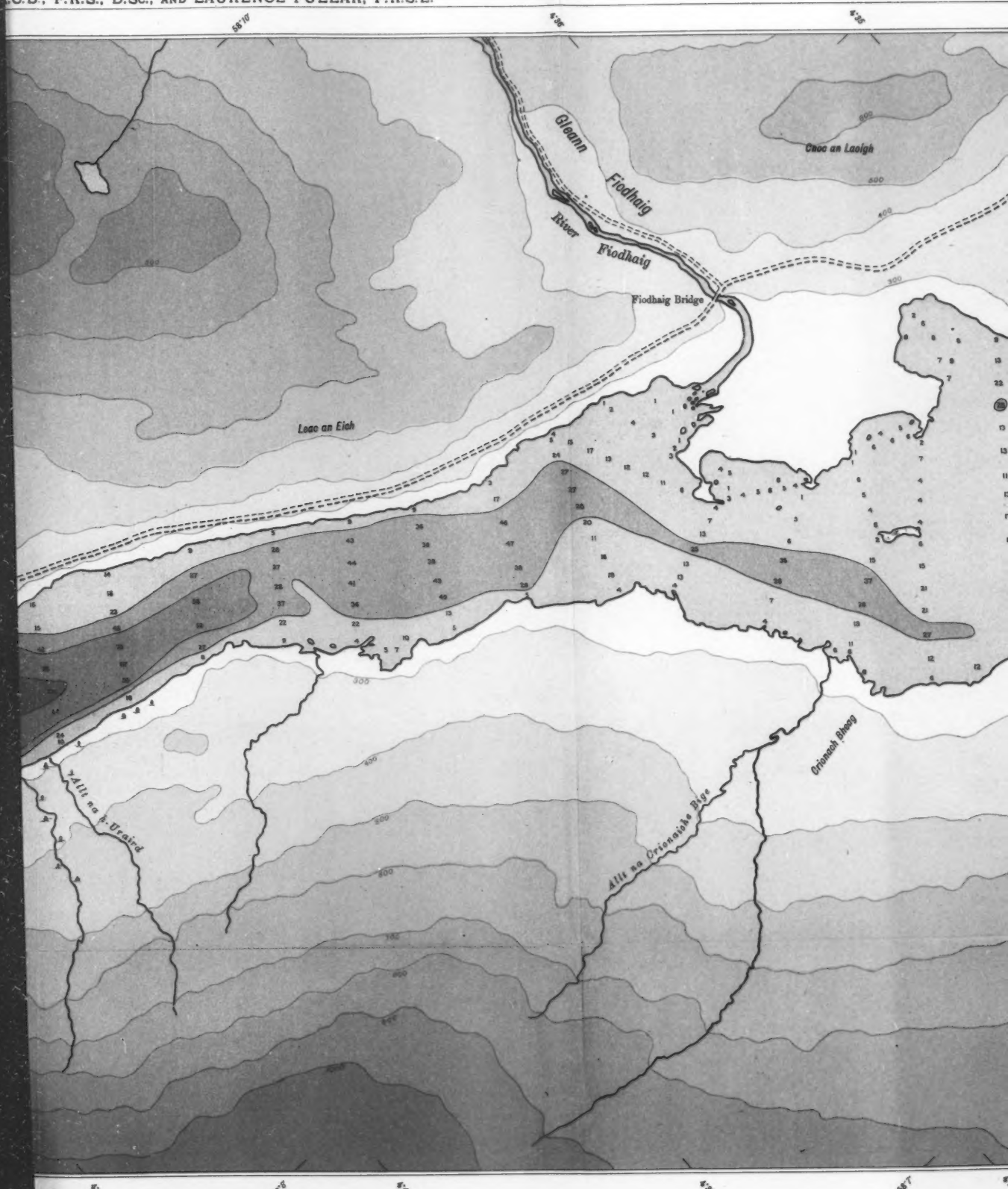
OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



INAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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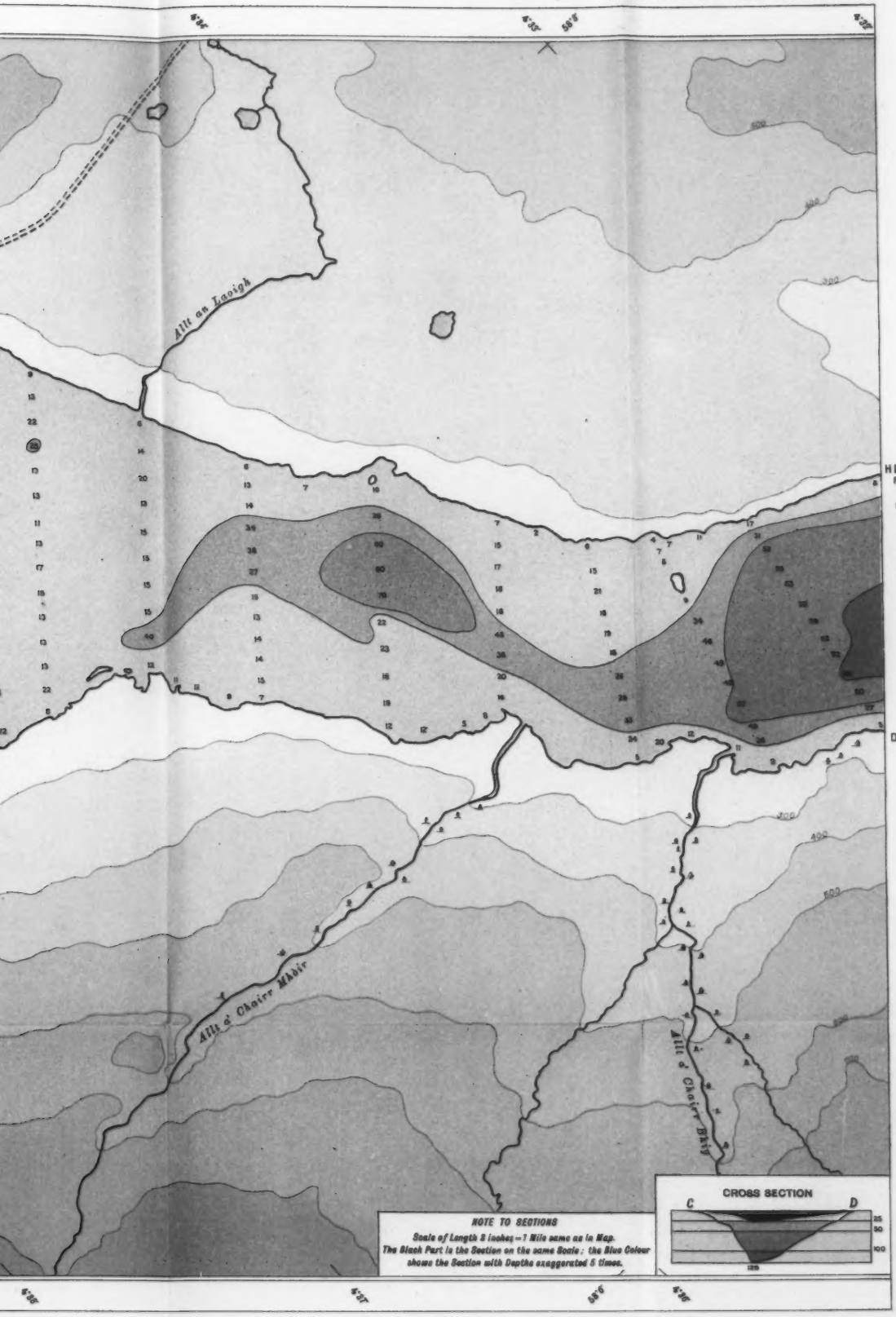
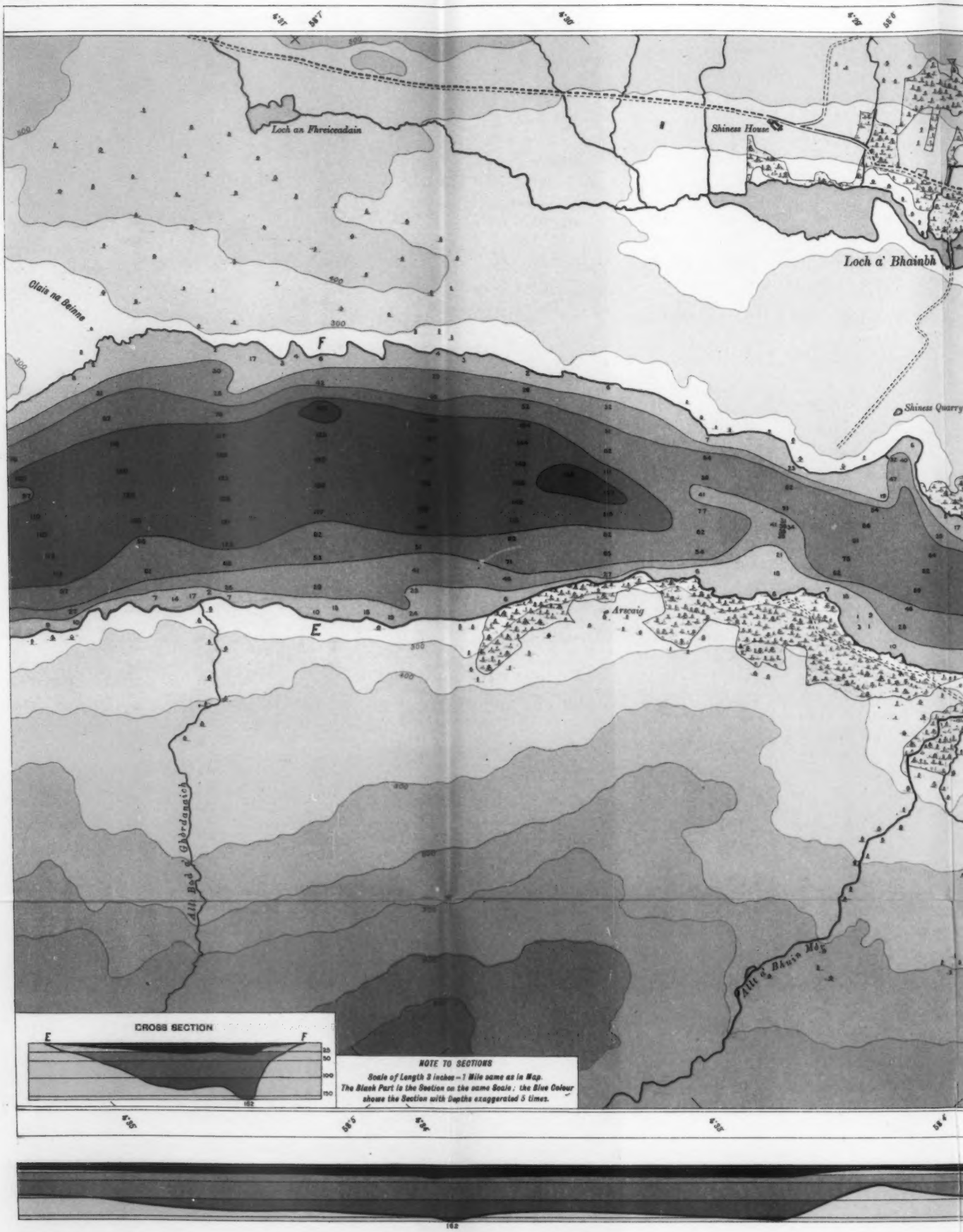


J. G. Bartholomew.

PLATE II


Loch an Fhreiceadain
Shiness House
Loch a' Bhainbh
Shiness Quarry
Allt Bad a' Ghobhar
Allt a' Bhuiridh Mòr
CROSS SECTION
E
F
NOTE TO SECTIONS
Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part in the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.

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BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCO

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

SECTION ALONG AXIS OF MAXIMUM DEPTH

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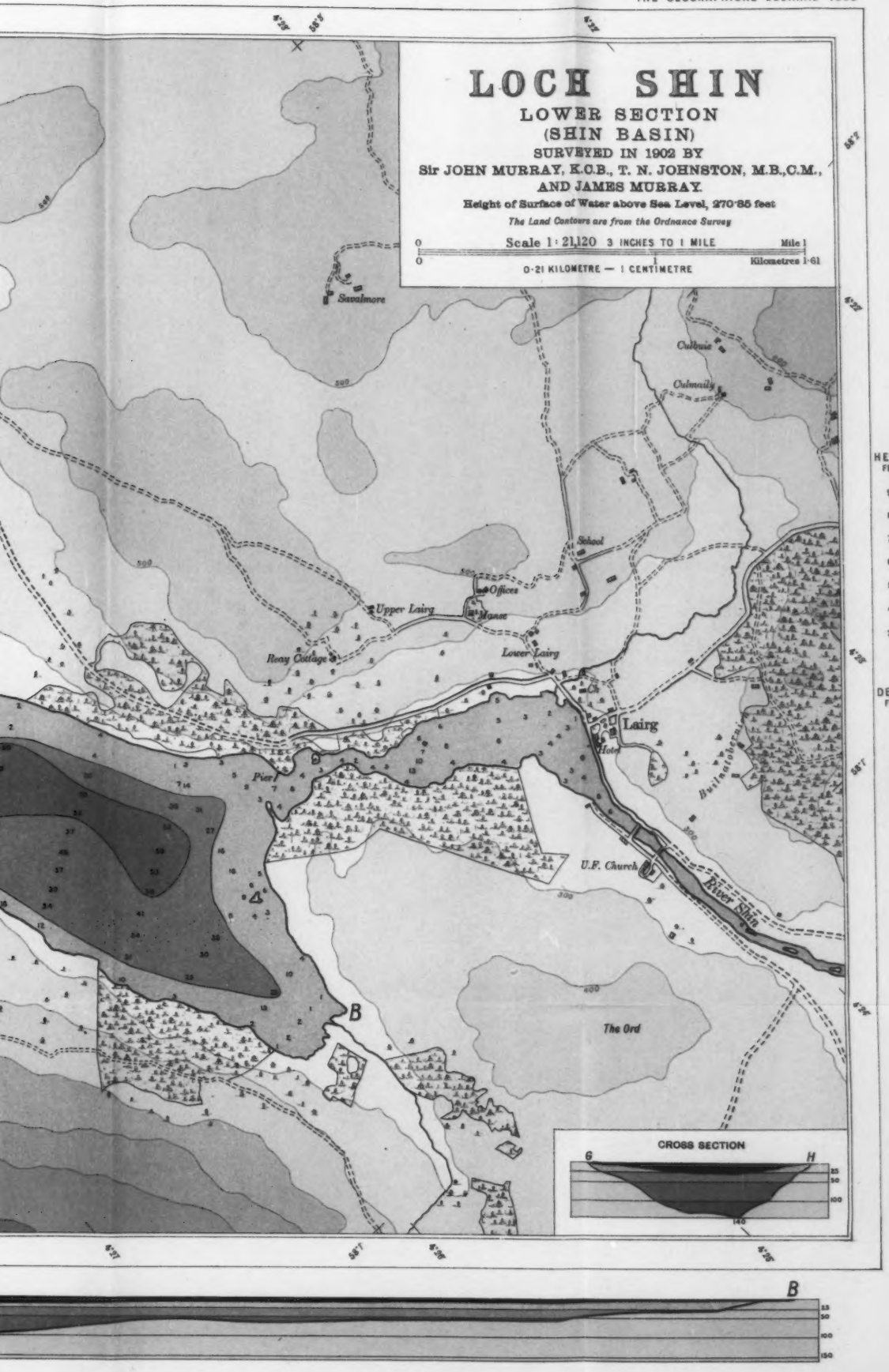

J. G. Bartholomew.

BATHYMETRICAL SURVEY OF THE FRESH-W

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAU

ATE III

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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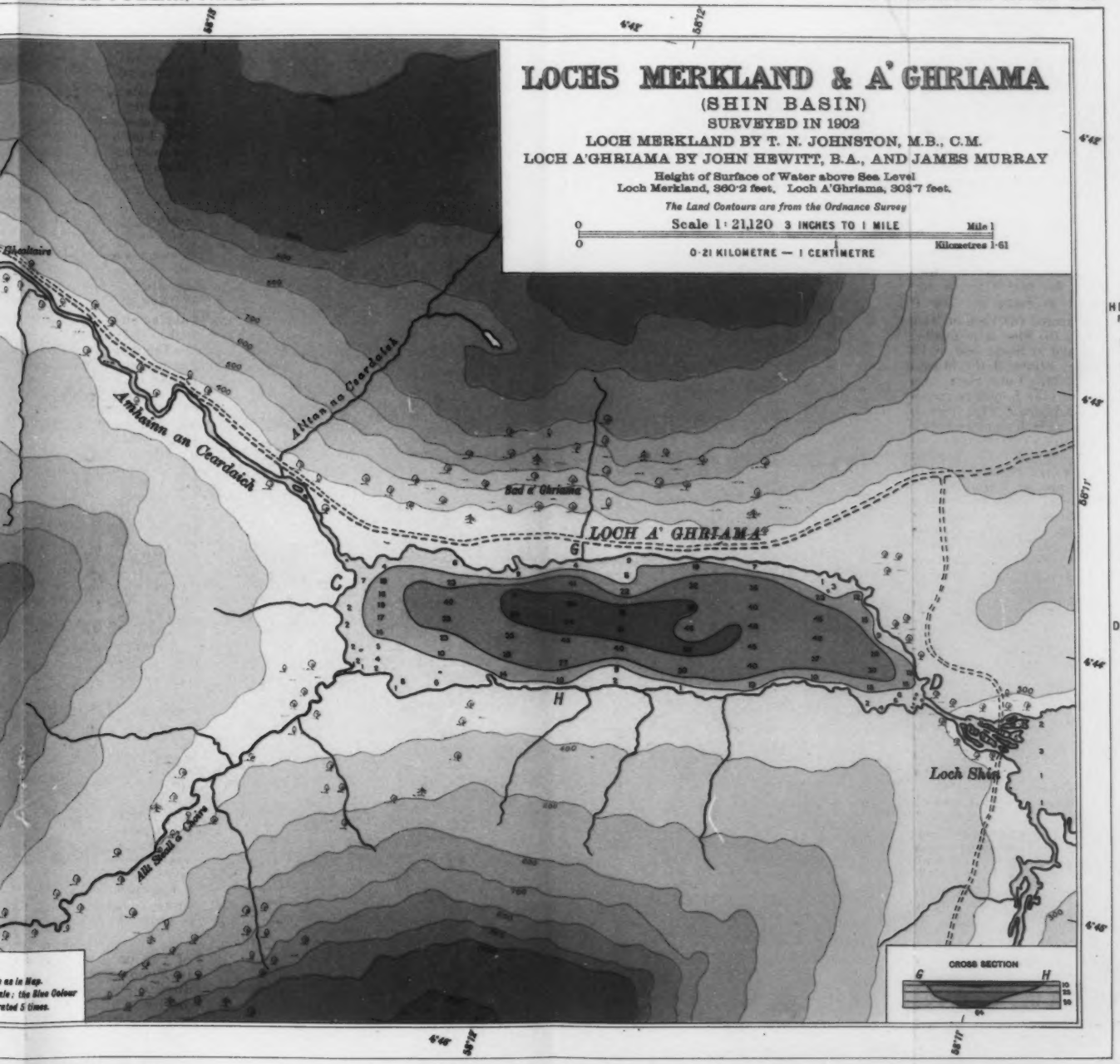
H-WATER LOCHS OF SCOTLAND

N OF

LAURENCE PULLAR, F.R.S.E.

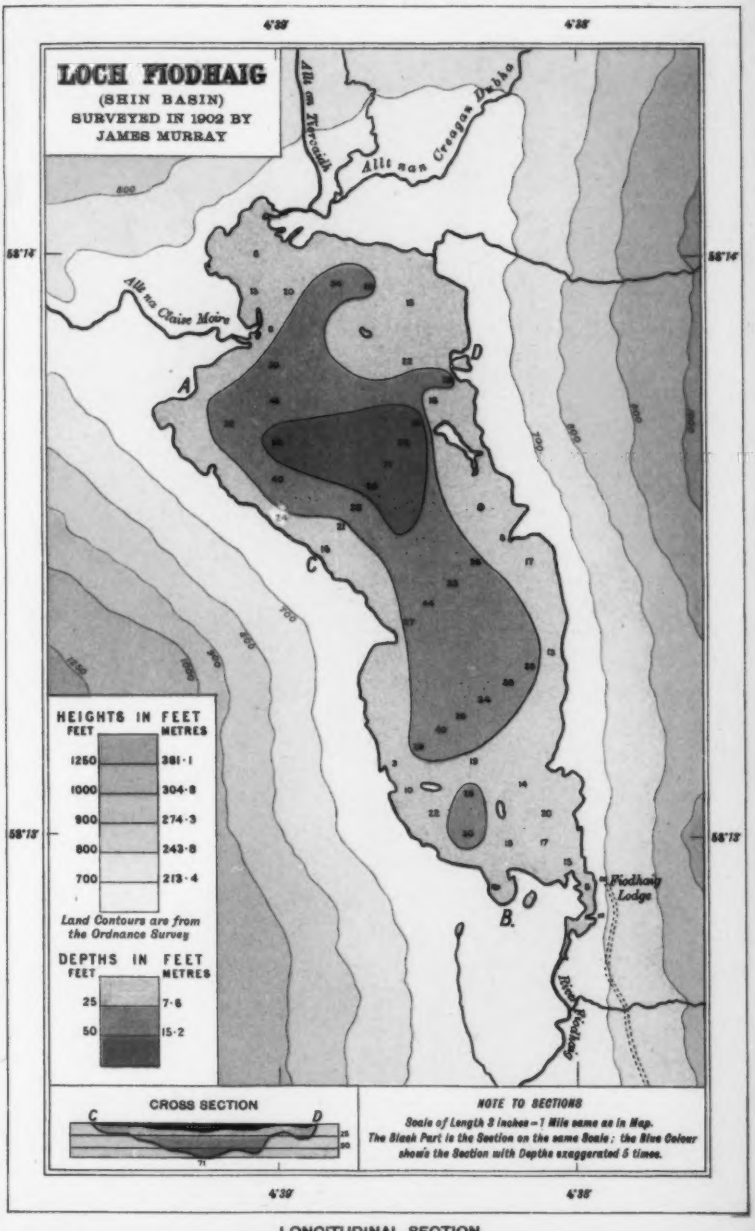


J. G. Bartholomew

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



The Edinburgh Geographical Institute 7 & 8 Bartholomew

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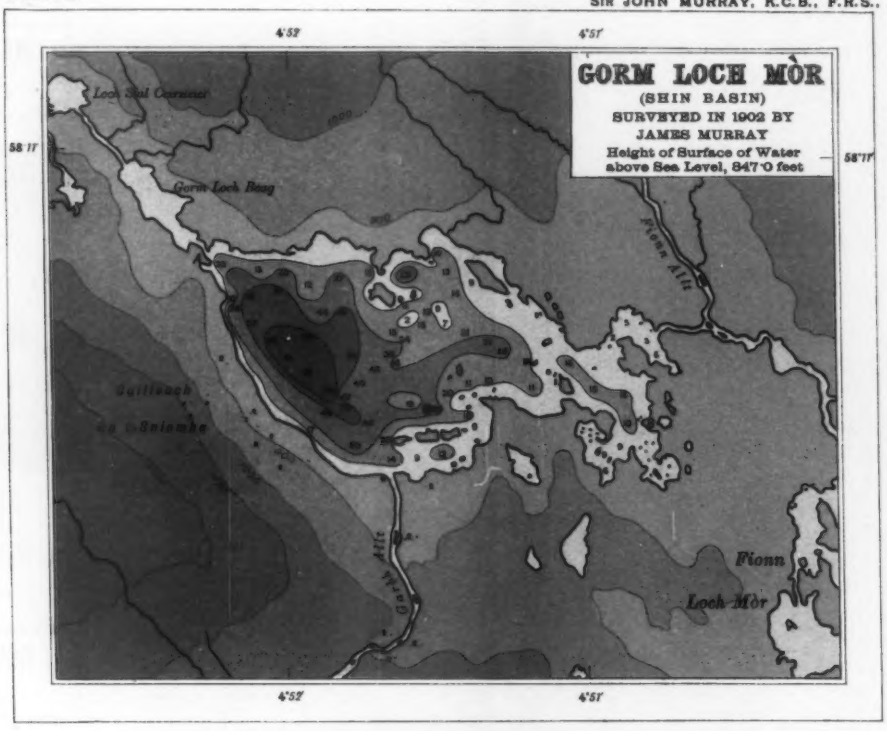
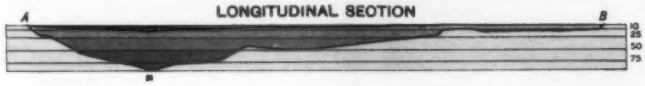
BATHYMETRICAL SURVEY OF THE FRESH-WA

UNDER THE DIRECTION OF

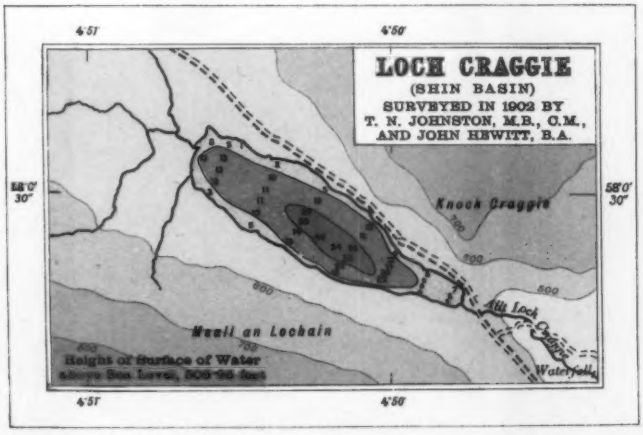
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAU

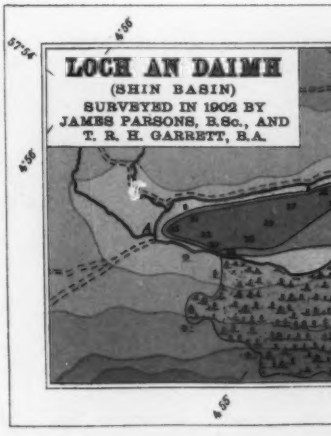
PLATE V





The Land Contours are from the Or





NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part in the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.

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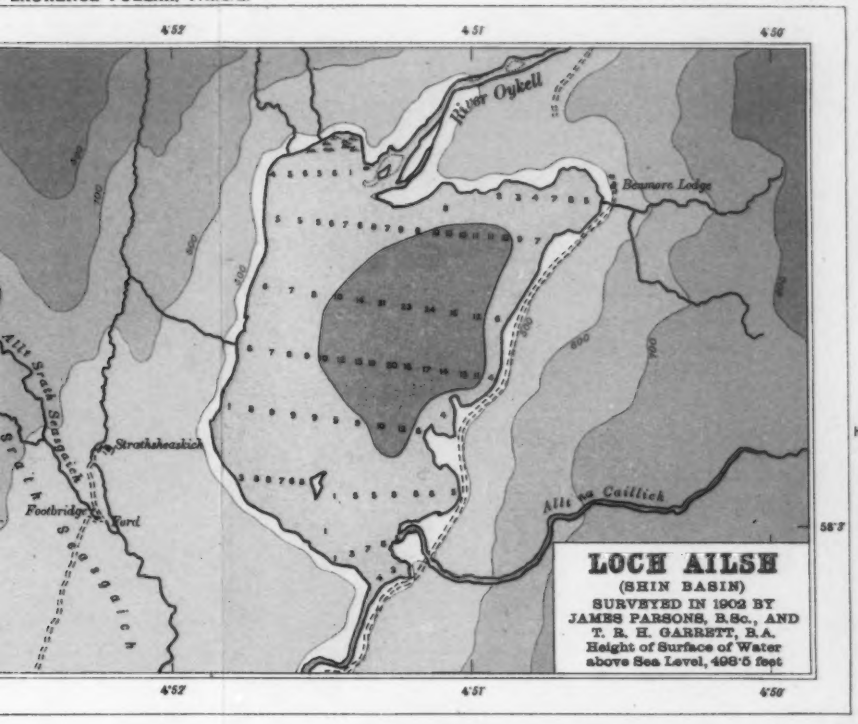
H-WATER LOCHS OF SCOTLAND

N OF
LAURENCE PULLAR, F.R.S.E.



HEIGHTS IN FEET

FEET	METRES
1500	457·2
1250	381·1
1000	304·8
900	274·3
800	243·8
700	213·4
600	182·9
500	152·4

the Ordnance Survey

Scale 1: 21,120 3 INCHES TO 1 MILE

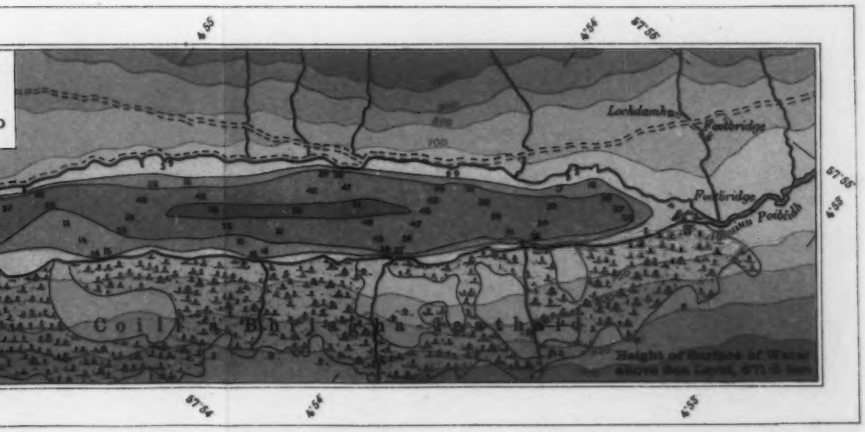
0 Mile 1

0·21 KILOMETRE — 1 CENTIMETRE

Kilometres 1·61

DEPTHS IN FEET

FEET	METRES
10	3·05
25	7·6
50	15·2
75	22·8



LONGITUDINAL SECTION

B

10
25
50

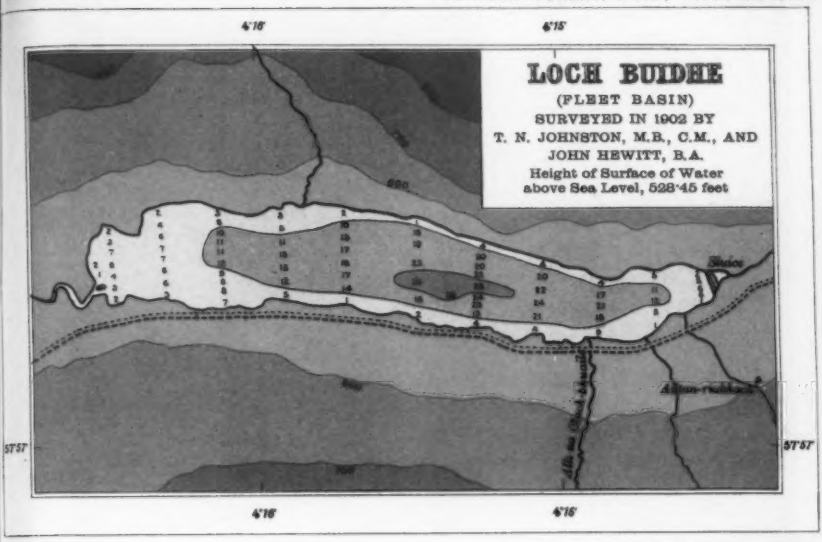
graphical Society.

J.G.Bartholomew.

BATHYMETRICAL SURVEY OF THE FRESH-WA

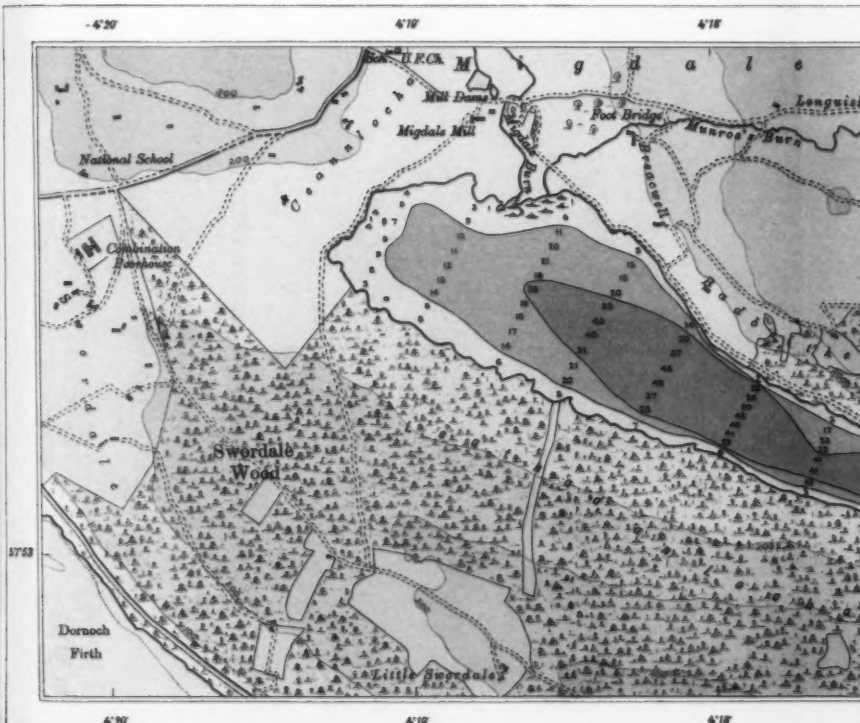
UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAU



Scale 1 : 21,120 3 INCHES TO 1

0·21 KILOMETRE — 1 CENTIMETR



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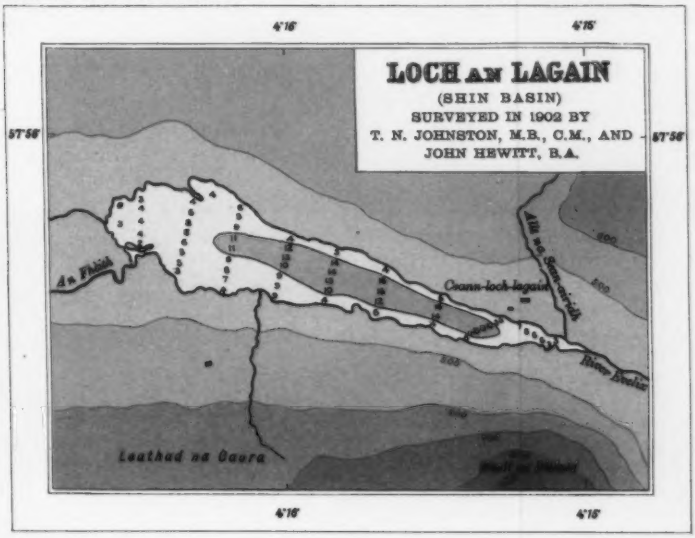
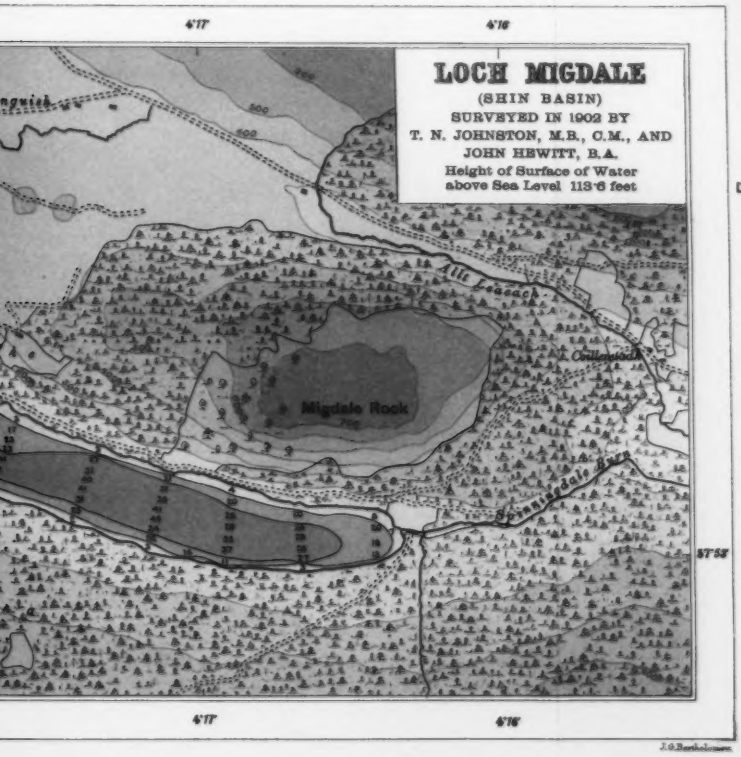


S TO 1 MILE Mile 1
Kilometres 1·61
TIMETRE

The Land Contours are from the Ordnance Survey

HEIGHTS IN FEET

FEET	METRES
900	274·3
800	243·8
700	213·4
600	182·9
500	152·4
400	121·9
300	91·4
200	61
100	30·5



DEPTHS IN FEET

FEET	METRES
10	3·05
25	7·6

J.G.Bartholomew